

The copyright of this thesis vests in the author. No quotation from it or information derived from it is to be published without full acknowledgement of the source. The thesis is to be used for private study or non-commercial research purposes only.

Published by the University of Cape Town (UCT) in terms of the non-exclusive license granted to UCT by the author.

# **The Landscape Pattern Surrounding the Venda Sacred Site of Thathe Forest**

Submitted in partial fulfillment of the requirements for the degree of  
Master of Philosophy in Environmental Management

By

**Adina Israel**

Department of Environmental and Geographical Science  
University of Cape Town

July 2012

Cape Town, South Africa





# Abstract

---

Natural sacred sites are areas protected by traditional groups as a point of connection to the land. They are also acknowledged for their disproportionate biodiversity contribution. These natural remnant patches have, however, recently come under threat from surrounding anthropogenic land-uses. This study aims to establish the spatial landscape pattern and associated land-uses surrounding the Venda sacred site of Thathe Forest in north-eastern Limpopo, South Africa, while investigating links to landscape governance. A terrain analysis of the study area is conducted using the thematic layers of geology and soils, gradient, aspect, and hydrology. This analysis is contrasted with a land-cover classification of the study area, further linking results to land-use decision-making.

Findings reveal that the north and south portions of the landscape are divergent both in their geophysical attributes and governance. Due to ecological conditions favourable for production in the south portion of the landscape, a complex political ecology situation evolved whereby this area was converted to commercial forestry under government control, while the northern area continued to be governed by traditional leadership and utilised for subsistence agriculture. This multifunctional landscape presents conflicts and synergies between diverging uses such as forestry and agriculture. The landscape pattern shows large-scale fragmentation in the plantation area, contrasted with small-scale fragmentation in tribal-controlled lands. The diverging conditions in the north and south of the landscape are reflected in the governance of the area and its lack of coordination, as two separate governing systems, traditional leadership and government, control the different areas. The greatest unplanned synergy occurs through a wide ecological corridor traversing the landscape with Thathe Forest at its centre. The sacred site is an important inception point of water flow, reaffirming existing eco-cultural knowledge, while its location strengthens the rationale for its legal protection.

These findings are instrumental in informing future natural sacred site protection efforts and landscape conservation. In order to ensure successful landscape management and long-term viability of this ecological corridor, the area should be protected by various stakeholders through joint management. Continued local stewardship is a key component as residents are the custodians of Thathe Forest and serve as “eyes in the landscape” to balance and possibly stem unwanted developments. To protect water quality and quantity, activities such as cultivation on steep land, clear cutting and use of chemical herbicides, should be avoided, particularly at high elevations. Synergies encouraging land efficiencies should be further explored and negotiated.

# Acknowledgements

---

This thesis has been written with the extensive participation and support of a multitude of individuals and a number of organisations. A deepest thanks must be given to the Mupo Foundation for supporting this research and particularly to Mphatheleni Makaulule for connecting us with the community of Tshidzivhe, and Elfrieda Pschorn-Strauss for your support and feedback. I would also like to thank the residents of Tshidzivhe for their contributions to the research by sharing their experiences and deep ecological understanding with us, and our translators for their hard work. A special thank you to Chief Netshidzivhe for granting us permission to conduct this study in the incredibly diverse Tshidzivhe landscape, as well as to the entire Netshidzivhe family for their hospitality. This project is also indebted to various subject experts, for your valuable time and shared insights as well as special contributions of data to the study. To my supervisor, Rachel Wynberg, your patience, insight, and experience reflected in your feedback and guidance have been deeply appreciated! To my fieldwork partner, Sam Lee Pan, it's been a pleasure sharing a great and interesting adventure with you! Finally, this project would not have been possible without the financial support of the Environmental Evaluation Unit at the University of Cape Town as well as the support of the Environmental Governance Project of the University of Cape Town's Vice-Chancellor's Strategic Fund.

# Table of Contents

---

<b>Abstract .....</b>	<b>i</b>
<b>Acknowledgements .....</b>	<b>ii</b>
<b>Table of Contents .....</b>	<b>iii</b>
<b>Abbreviations .....</b>	<b>v</b>
<b>List of Figures .....</b>	<b>vi</b>
<b>List of Tables .....</b>	<b>viii</b>
<b>List of Appendices .....</b>	<b>ix</b>
<b>Chapter 1: Introduction .....</b>	<b>1</b>
1.1 Background .....	1
1.2 Research Rationale and Relevance .....	1
1.3 Study Area Context .....	2
1.4 Research Aim and Objectives .....	4
1.5 Research Approach .....	4
1.6 Chapter Outline .....	5
<b>Chapter 2: Literature Review .....</b>	<b>6</b>
2.1 Introduction .....	6
2.2 Context of the Venda Landscape .....	6
2.3 Socio-ecological Landscapes .....	10
2.4 Landscape Management .....	11
2.5 The Landscape Pattern .....	13
2.6 Conclusion .....	14
<b>Chapter 3: Research Methods .....</b>	<b>16</b>
3.1 Review of Existing Methods .....	16
3.2 Study Design .....	17
3.3 Study Area Selection .....	18
3.4 Landscape Ground-truthing Investigation .....	19
3.5 Key Informant Interviews .....	23
3.6 Thematic Layer Mapping .....	24
3.7 Landscape Classification .....	26
3.8 Study Limitations .....	28
3.9. Synthesis of Qualitative and Quantitative Methods .....	30
<b>Chapter 4: Results .....</b>	<b>31</b>
4.1 Introduction .....	31
4.2 Landscape Structure .....	31
4.3 Land-use Governance .....	53
4.4 Summary .....	58
<b>Chapter 5: Major Findings and Discussion .....</b>	<b>60</b>
5.1 Introduction .....	60
5.2 Multifunctional Landscape .....	60
5.3 Landscape Pattern .....	68
5.4 Landscape Governance Conflict .....	76
5.5 Reflection and Synthesis .....	80
<b>Chapter 6: Conclusions and Recommendations .....</b>	<b>82</b>
6.1 Review of Findings .....	82
6.2 Implications for Landscape Management and Recommendations .....	83
6.3 Implications for Thathe Forest? .....	85

6.4 Further studies and exploration .....	86
<b>References .....</b>	<b>88</b>
<b>Appendices.....</b>	<b>94</b>
Appendix A: Research Protocol Agreement.....	94
Appendix B: GIS Layer Information .....	96
Appendix C: Guided Site Investigation Details.....	97
Appendix D: Key Informant Details .....	98
Appendix E: Key Informant Interview Questions.....	99

University of Cape Town

# Abbreviations

---

**CSAG** Climate Systems Analysis Group

**DAFF** Department of Agriculture, Forestry, and Fisheries

**DEM** Digital Elevation Model

**DWAF** Department of Water Affairs and Forestry

**FSC** Forest Stewardship Council

**GIS** Geographic Information System

**GPS** Geographic Positioning System

**IEMP** Integrated Environmental Management Plan

**LEDET** Limpopo Economic Development, Environment, and Tourism

**QGIS** Quantum Geographic Information System

**UCT** University of Cape Town

**VDM** Vhembe District Municipality

# List of Figures

---

<b>Figure 1.1:</b> Location of former Venda homeland in South Africa (source: South African History Online) .	1
<b>Figure 1.2:</b> Regional context of the study area (adapted from: Department of Environment and Tourism, University of Pretoria and GIS Business Solutions) .....	2
<b>Figure 3.1:</b> The study area boundaries and associated land management authorities.....	18
<b>Figure 3.2:</b> GPS tracks of site investigations during fieldwork.....	20
<b>Figure 3.3:</b> Conceptual example of thematic layering (source: ndimensionalgis.com, 2011).....	24
<b>Figure 3.4:</b> Landscape classification visual key showing aerial imagery on the right and site photos on the left.....	26
<b>Figure 4.1:</b> Geology of the study area showing formations and faults.....	34
<b>Figure 4.2:</b> Gradient of the study area, showing the degree of steepness of slopes .....	35
<b>Figure 4.3:</b> Aspect of the study area, showing facing direction of slopes. ....	36
<b>Figure 4.4:</b> Hydrology and drainage of the study area, showing direction of water flow, catchments, rivers, and main water bodies .....	37
<b>Figure 4.5:</b> Climatic conditions characterising the study area.....	33
<b>Figure 4.6:</b> Landscape classification of the study area showing land-cover and related land-use .....	39
<b>Figure 4.7:</b> Area analysis by classification type .....	40
<b>Figure 4.8:</b> The northeast extreme of Lake Fundudzi, looking northwest.....	41
<b>Figure 4.9:</b> View looking south from Vhulambangwe hill over Northern Mistbelt Forest ( <i>daka</i> ) to Mukumbani Dam.....	42
<b>Figure 4.10:</b> Boulders overgrown by forest ( <i>matalalani</i> ) .....	42
<b>Figure 4.11:</b> Bushveld vegetation varies in density and structure between peaks and valleys .....	43
<b>Figure 4.12:</b> Grasslands ( <i>midavini</i> ) near Nwanani. Note encroaching <i>Pinus</i> species.....	44
<b>Figure 4.13:</b> Rocklands ( <i>gwara</i> ) near Nwanani.....	44
<b>Figure 4.14:</b> Thathe Forest surrounded by young plantation compartments (looking northwest from Vhulmbangwe hill) .....	45
<b>Figure 4.15:</b> Indigenous vegetation reclaiming former wetland which was turned into a plantation compartment. ....	46
<b>Figure 4.16:</b> Young pine plantation with a remnant indigenous forest flanking a river valley, winding forestry roads, and linear firebreak (looking south from a ridge west of Tshidzivhe village) .....	47
<b>Figure 4.17:</b> A grazing pasture forming part of the disturbed land classification.....	48
<b>Figure 4.18:</b> Fields and crops surrounding a homestead in the Mulume area .....	49
<b>Figure 4.19:</b> Maize planted on a slope amongst boulders.....	50
<b>Figure 4.20:</b> Homesteads in the southeast area of Tshidzivhe village .....	50

<b>Figure 5.1:</b> Land-use area comparison according to proportions of anthropogenic use and indigenous vegetation in the north and south portions of the study area .....	64
<b>Figure 5.2:</b> The distribution relation between land-use and gradient in the study area .....	67
<b>Figure 5.3:</b> Roads throughout the study area, showing the high geographical fragmentation throughout the plantation area. ....	72
<b>Figure 5.4:</b> Structural fragmentation surrounding subsistence agriculture land-uses.....	73
<b>Figure 5.5:</b> Composite map showing the three main land-uses (subsistence agriculture, commercial forestry, and indigenous vegetation) and the fragmentation types throughout the landscape....	75

University of Cape Town



# List of Tables

---

<b>Table 1:</b> Key decision-making actors in the study area.....	4
<b>Table 2:</b> Conflicts and synergies between tribal-ruled area and Komatiland managed area .....	66
<b>Table 3:</b> Assessment of landscape pattern elements in subsistence agriculture and commercial forestry lands (adapted from Fischer et al., 2006) .....	70
<b>Table 4:</b> The decision-making authorities in the study area and their interaction with a variety of landscape elements.....	78

University of Cape Town

# List of Appendices

---

<b>Appendix A:</b> Research Protocol Agreement.....	94
<b>Appendix B:</b> GIS Layer Information .....	96
<b>Appendix C:</b> Guided Site Investigation Details.....	97
<b>Appendix D:</b> Key Informant Details .....	98
<b>Appendix E:</b> Key Informant Interview Questions.....	99

University of Cape Town



# Chapter 1: Introduction

---

## **1.1 Background**

Natural sacred sites are areas traditionally protected by local communities and usually carry religious and cultural significance (Tiwari et al., 1998; Ormsby & Bhagwat, 2010). The VhaVenda (Venda people) of north-eastern Limpopo, South Africa (Figure 1.1), steward such sacred sites which play an important part in their beliefs and traditions (Tshivhugo, 2008). Two of the most important Venda sacred sites are Thathe Forest and Lake Fundudzi, located in the complex and fragmented cultural landscape of the Soutpansberg Mountain Bushveld. Other than their important role in Venda tradition and ritual, the sacred sites act as key ecosystem components and



**Figure 1.1: Location of former Venda homeland in South Africa (source: South African History Online)**

contain much of the biodiversity in the landscape (Tshivhugo, 2008) and therefore provide significant ecosystem services to a variety of landscape users (Tiwari et al., 1998; Bhagwat & Rutte, 2006). As sacred sites are greatly affected by the surrounding landscape and associated land-uses (Tshivhugo, 2008), it is important to understand the potential effects of anthropogenic activities on these remaining pockets of biodiversity. This is particularly important in light of the link between biodiversity and ecosystem services provision and the contribution of these to landscape functionality (Fischer et al., 2006).

## **1.2 Research Rationale and Relevance**

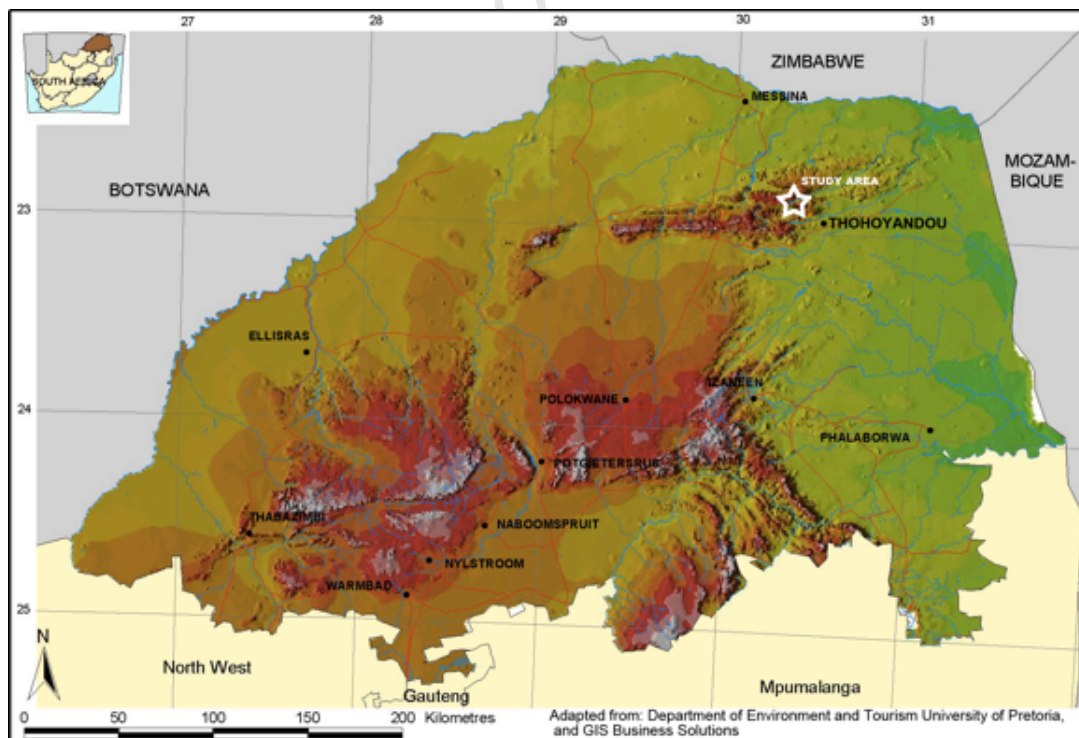
This study is an inquiry into the landscape context of Venda sacred sites in their socio-ecological landscape. As sacred sites are shrinking, it is important to understand their geo-spatial context and surrounding land-uses to promote informed landscape planning and decision-making. Further, the documented landscape context of sacred sites can assist local groups in the process of legal registration of the sites with the South African government, protecting them as heritage resources (SAHRA, 2011). The information produced will assist community leaders in the spatial planning of their land by providing an alternate perspective on the interconnections and

relationships between surrounding land-uses and sacred sites. Findings can also aid municipal and regional planners in decision-making regarding future landscape planning and policy.

Lately, the Venda sacred sites have increasingly come under threat from encroaching uses including development, tourism, and agriculture. This has instigated a local non-governmental organisation, the Mupo Foundation, to work with community members to secure protection for these sites. The scientific information gathered as part of this project complements the existing indigenous knowledge recorded by the community. Jointly, these sets of information can be used by the Mupo Foundation to communicate the effects of the surrounding landscape on the social and ecological roles of sacred sites to external stakeholders and decision-makers. In terms of their contribution to the project, the Mupo Foundation facilitated contact with the community by introducing the project to the community and assisting with research logistics, with the understanding that the information produced can support and assist its work.

### **1.3 Study Area Context**

The Venda region is a former South African homeland located in far north-east Limpopo bordering Zimbabwe to the north (Figure 1.1). The study area is located in the Soutpansberg



**Figure 1.2: Regional context of the study area (adapted from: Department of Environment and Tourism, University of Pretoria and GIS Business Solutions)**

mountain range, northwest of the town of Thohoyandou, and consists almost entirely of the Tshidzivhe territory, with its main settlement being of the same name (Figure 1.2). Like many communal lands in Venda, the study area has been through many social and landscape changes and has a difficult past.

Historically, homesteads were evenly distributed in the Tshidzivhe landscape and each family owned its own subsistence fields and fruit trees. Residents inhabited and ploughed the grassy highlands and moderate slopes. The establishment of the Thathe Vondo commercial pine plantation in 1949 was responsible for forcibly removing residents from the western side of Tshidzivhe territory. Removals in the eastern portion of Tshidzivhe, from where most Tshidzivhe village residents originate, occurred in the early 1970s due to the establishment of the Tshamanyatsha plantation. This latter plantation was incorporated into Thathe Vondo plantation in the 1990s (Nemakhavhani, pers. comm., February 2012). The establishment of the Tshamanyatsha plantation forced residents to cluster their homesteads on some of the steepest terrain of the Tshidzivhe land, leading to the building of homes and crop cultivation in areas susceptible to landslides and soil erosion (Elder Aaron, pers. comm., February 2012). Currently, a land dispute still exists over the southern portion of the Tshidzivhe territory, managed by Komatiland Forests but officially registered to the South African Department of Agriculture, Forestry, and Fisheries (DAFF). A land claim application was submitted in 2006 by a consortium of local communities, amongst them the Tshidzivhe community.

Despite its geographical proximity to Thohoyandou, Tshidzivhe is relatively remote due to poor circuitous roads and mountainous terrain. Access is also possible from the south through the plantation, however, this route is longer with more problematic roads therefore is not used regularly for access to Tshidzivhe village, but is used to access the hamlets situated in the western areas of the Tshidzivhe territory such as Mulume and Tshitangani. Services in the area are limited; electricity infrastructure was recently erected in Tshidzivhe village, whereas water is obtained through pipes that channel water from mountain springs to homesteads.

The key decision-making actors in the study area consist of Chief Netshidzivhe as the traditional leader of the Tshidzivhe territory, Thulamela Municipality, Vhembe District Municipality (VDM), and Komatiland Forests as a parastatal arm's-length organisation of Department of Agriculture, Forestry, and Fisheries (DAFF). The various actors are listed in Table 1 including their role and resource management influence.

<b>Decision-making Area</b>	<b>Chief Netshidzivhe</b>	<b>Thulamela Municipality</b>	<b>Vhembe District Municipality</b>	<b>Komatiland (DAFF)</b>
Area of influence within study area	North portion of Tshidzivhe Territory	North portion of Tshidzivhe Territory	North portion of Tshidzivhe Territory	South portion of Tshidzivhe Territory
Decision-making Role	Mainly land-use related and dispute resolution	Conceptual: plans and policies	Conceptual: plans and policies	Daily plantation operation and management of conservation areas
Landscape Resource Management	Fruit and vegetable crops, livestock, small-scale forestry, harvested plants, firewood	Provision of local physical infrastructure (ex: water pipes, electrical poles)	Regional service supply infrastructure (ex: dams, bulk electricity)	Commercial forestry, conservation corridors, and water quality monitoring

**Table 1: Key decision-making actors in the study area**

## **1.4 Research Aim and Objectives**

This dissertation aims to establish the spatial landscape pattern and associated land-uses surrounding Thathe Forest while investigating links to landscape governance. The study will explore the following main research question:

**“How is the landscape pattern and associated land-uses arranged around the Venda sacred site of Thathe Forest?”**

The research question can be further broken down into three objectives to be fulfilled by the study:

1. To gain an understanding of the spatial relationship between the dominant land cover patches in the study area.
2. To investigate the links between physical terrain features, current land-uses, and human dimensions.
3. To explore decision-making processes related to land-use in the study area.

## **1.5 Research Approach**

This project explores and describes the landscape pattern of the study area while relating thematic layers of topography, geology and soils, hydrology, and climate to a land cover classification, and further linking these to the land-use decision-making process. In terms of

technical analysis, both the fields of geographic information systems (GIS) analysis and landscape ecology offer a wide array of methodologies to undertake the required mapping. However, rather than exploring various methodologies, the intent here is to explore the relationship between the landscape and its human dimensions in a rapid assessment approach often practiced in landscape and environmental planning. Therefore the scope of the study is to examine the landscape pattern and the relationship between its elements at a single point in time, using accessible low-technology methods, and then relating these to the existing human dimensions in the study area. The spatial analysis is undertaken using the open source software package Quantum Geographic Information Systems (QGIS) version 1.7.2 and compatible file formats such as shapefiles (vector format) and rasters (image format).

## **1.6 Chapter Outline**

With consideration to the above context of the natural Venda sacred sites, the research aim and objectives, as well as the study approach, the remainder chapters of this study are organised as follows:

**Chapter 2** provides the context of the Venda landscape, as well as a literature review of socio-ecological landscapes, landscape management and the landscape ecology principles behind management guidelines.

**Chapter 3** describes the study design, study area selection, the various methods used including mapping techniques and fieldwork, as well as their associated limitations.

**Chapter 4** details the study results. This includes descriptions of the landscape pattern, landscape classification, the role of Thathe Forest, and associated governance of the area.

**Chapter 5** analyses findings and discusses the multifunctional roles of the landscape, the landscape pattern, and related governance conflicts rooted in the political ecology of the area.

**Chapter 6** summarises the key findings of the study and provides recommendations regarding future natural site protection and landscape conservation in the Venda landscape.



# Chapter 2: Literature Review

---

## **2.1 Introduction**

In order to ground the research project, the context of the Venda landscape is examined by describing the sacred sites and their surroundings. Relevant theoretical frameworks applicable to the research objectives are also explored. The subject is examined from a number of angles drawing on a variety of relevant literature comprising websites, reports, magazines, journal articles, dissertations, and books. In an effort to include information regarding the particular subject landscape, materials other than academic publications have also been reviewed. The research topic is broken into a number of key components: The context of the Venda landscape in terms of land-uses, the role of sacred sites, and governance; a review of socio-ecological systems and cultural landscapes; and lastly, an overview of landscape management and associated landscape ecology concepts as a toolkit for decision-making and evaluating the existing landscape.

## **2.2 Context of the Venda Landscape**

Traditionally, the VhaVenda inhabited the mountain highlands and hillsides, having converted grasslands and forest into settlements and cultivation fields (van der Waal, 1997). Commercial plantations, triggered by South Africa's need for timber, were established in Venda in the 1930s and 1940s by the South African Department of Forestry and then expanded in the 1970s by the Venda Department of Agriculture and Forestry (Lahiff, 2000). These activities coincided with the implementation of forced land-use re-designation, known as 'betterment', leading to forced removals of local people and their re-settlement in the lowlands in clustered European city grid hamlets and villages (Lahiff, 2000; Tshiguvho, 2008).

Currently, Venda villages are scattered in the landscape with surrounding subsistence agriculture. This type of land-based livelihood is highly dependent on the ecosystem services provided by natural resources such as soils, vegetation, water and related topography (van Averbek & Bennett, 2007). Ecosystem services are commonly understood as the benefits people derive from the goods and services provided by ecosystem function (Costanza et al., 1997). In addition to subsistence agriculture, the landscape is characterised by commercial forest plantations and other commercial-scale crops of tea and fruit trees, replacing indigenous grassland, bushveld, and forest (van der Waal, 1997; Khorombi, 2000; Tshiguvho, 2008). However,

small remnants of original forest are left in the region (Tshiguvho, 2008). The cumulative effect of commercial plantations and subsistence agriculture has caused land erosion and degradation resulting in the silting of the rivers and the sacred Lake Fundudzi (Khorombi, 2000) as well as a severely fragmented and complex landscape. Additionally, the collection of natural products from forests and wetlands as well as grazing has put additional strains on water sources (Khorombi, 2000; Silima, 2007), including the traditionally protected Venda sacred sites (Tshiguvho, 2008).

Sacred sites are places of spiritual or religious importance to local communities as connection points to land and nature (Blain & Wallis, 2004; Ormsby & Bhagwat, 2010). In traditional cultures, local groups applied special rules and restrictions to special sites. This can be considered as a form of community-based conservation due to the unusually high biodiversity of the sites compared to the surrounding, often agricultural, anthropogenic landscape (Bhagwat & Rutte, 2006). The purposes of sacred sites are different in every culture but often include burials, religious rituals, and recognition of the value of watersheds (Ormsby & Bhagwat, 2010). Sacred sites differ in size depending on the role of the site and its stewards. Some sites can be as small as a few metres ranging to a number of hectares, forming an entire sacred landscape (Anderson et al., 2005). Sacred sites have been recognized for their biodiversity value as they have been protected from anthropogenic effects for generations, and often constitute some of the only remaining natural vegetation patches in anthropogenic landscapes. Despite their crucial ecological role and contribution to ecosystem services, many sacred sites have come under threat from development, tourism, and different commercial agriculture industries in many parts of the world (Anderson et al., 2005; Ormsby & Bhagwat, 2010).

In Venda, small patches of sacred sites have escaped degradation as they were under the control of their owners (Tshiguvho, 2008). Sacred sites play a focal role in Venda culture, as rituals and beliefs are reliant on the natural world and have been practised for centuries. This system of beliefs integrates social rules, environmental management, religion, and law into one set of societal rules, passed down from generation to generation. Sacred sites usually demarcate the original land of the ancestors or the final resting place of the forefathers. Different Venda sacred sites serve different purposes such as burial grounds, sacred rituals, and commemoration of historic events (Tshiguvho, 2008). However, in the context of this study, sacred sites refer to areas off-bounds to visitors (Zwifho), differentiated from historic or heritage sites generally referred to as sacred sites in literature (Tshiguvho, 2008; Pschorn-Strauss, pers. comm., July 2012). Sacred sites are located in a variety of areas, although many sacred sites denote water sources and

therefore have a strong connection to water (Tshiguvho, 2008; Ecologist, 2011). In this context, sacred sites provide important ecosystem services through watershed protection (Tiwari et al., 1998; Ormsby & Bhagwat, 2010). Thathe Forest and Lake Fundudzi are key examples of such sites, and are said to be perhaps the most sacred of sites for all VhaVenda clans (Tshiguvho, 2008).

This world order has degraded in the last few decades due to the introduction of Christianity, modernisation, and economic conditions whereby VhaVenda are forced to migrate to bigger economic centres therefore eroding the social structure (Tshiguvho, 2008; Mupo Foundation, 2010). In the past, tribal law governed the Venda region and power resided with the chief and makhadzis (female stewards of sacred sites), however this has drastically changed over time and clans no longer recognise the traditional authority as they once did (Khorombi, 2000; Ecologist, 2011). Currently, decisions related to land are made both by the chief and government officials leading to confusion, disagreements, and poor land management practices (Khorombi, 2000; Oomen, 2005).

Cultural change in rural South Africa was dramatic after the end of Apartheid when municipalities, governed by democratically elected councillors, were introduced in the rural areas, thereby challenging the roles of chiefs and their consolidated power (Ntsebeza, 2003). Currently, many rural land-use decisions are made by chiefs in historically determined territories. In these settings, the chief is often the residents' sole portal to land acquisition and associated land-use permissions, therefore yielding a powerful position (Lahiff, 2000; Oomen, 2005). However, the roles and powers of traditional leaders in rural areas of South Africa are unclear, as many services they provided before the end of Apartheid are similar to those currently provided by a democratically elected municipal government. This situation arose through the new constitution giving recognition to traditional leadership while keeping its role ambiguous (Ntsebeza, 2003). In practice, traditional leaders' roles in rural South Africa range from community dispute resolution to land-use and resource allocation, various administrative roles, and acting as the portal to state government for the community (Oomen, 2005). This creates an awkward overlap between chiefs and municipal officials, who may at times be the chief's "subjects", also leading to a situation of "two bulls in a kraal" (Oomen, 2005) where decision-making by traditional authorities and elected officials are likely to clash, causing tension and disputes (Khorombi, 2000; Oomen, 2005).

As in many of the former homelands, a large proportion of land in the Venda region is held in the form of communal tenure. This means that the state nominally owns the land while in effect it is

the chief and headmen who control the land in their territory and allocate property to community households (Lahiff, 2000). With the inception of a democratic South Africa, tribal chiefs maintained most of their powers and control over land (Lahiff, 2000; Ntsebeza, 2003), although they have been largely excluded from the broader municipal decision-making arena. To this effect, traditional leaders make land-use decisions solely within their territory with minimal influence on broader scale decisions (Oomen, 2005).

Commercial forestry and agriculture amongst other anthropogenic uses throughout the Lake Fundudzi watershed have been a main contributor to decreased water flow and quality (van der Waal, 1997; Khorombi, 2000; Nemukula, 2005). High water consumption by commercially planted *Pinus* species are likely responsible for changes in the water cycle of the area (Carrere & Lohmann, 1996), leading to decreased water flow in streams and declining water levels in Lake Fundudzi (van der Waal, 1997). In the study area, pine plantations are also responsible for increased soil and water acidity (Nemukula, 2005), and for removal of nutrients from the soil (Carrere & Lohmann, 1996). Commercial pine plantations further alter the existing hydrological cycle through formation of a dense needle mat, replacing the indigenous groundcover, thus encouraging surface runoff instead of percolation of water into the soil (Carrere & Lohmann, 1996; Starkloff, 1998). Indigenous vegetation removal, pine tree felling, maintenance of forestry roads, as well as agricultural practices on steep slopes are responsible for soil erosion, which in turn, contributes to the declining levels in Lake Fundudzi and water contamination through sedimentation (van der Waal, 1997; Nemukula, 2005). In addition, water quality is degraded by local villages where soaps and other contaminants enter water streams (Nemukula, 2005). Likewise, the control of water-demanding invasive species within plantation boundaries often require the use of herbicides which are likely to find their way into streams, contaminating water and soil (Carrere & Lohmann, 1996).

The Venda landscape is tightly linked through ecological, social, and economic elements. The ecological resources of the area provide economic benefits in terms of subsistence and small-scale agriculture to rural communities and financial gain to the forestry, tourism, and mining industries (Mabogo, 1990; Tshivugho, 2008; Mupo Foundation, 2010). The rich environmental context and its mystical qualities form the foundation for the Venda culture, rituals, and customs which in turn encourage sacred site conservation (Mupo Foundation, 2010). Cultural aspects also have a bearing on economic conditions as some land is set aside for cultural uses and is traditionally unacceptable to use for economic gain. Contrastingly, economic forces due to timber demand have transformed parts of the landscape through afforestation (Lahiff, 2000), as

economically-driven pressures often dictate short-term dynamics at the expense of long-term sustainability (Büscher & de Beer, 2010). The economic state of the region, where rural areas are based largely on subsistence agriculture, has a considerable effect on cultural change. The younger generation is interested in gaining employment in the cities, therefore leaving their community and altering the existing social structure. The interest in acquiring monetary wealth is also driving leaders and families to cast aside cultural rites and traditions in favour of a more modern life style (Ecologist, 2011).

### **2.3 Socio-ecological Landscapes**

Diverging from the accepted utilitarian method of resource management which typically decouples the natural world from social systems, Berkes et al. (1998) advocate for a systems approach where the social and ecological realms are treated as a unit. The authors argue that because social and ecological realms are intricately interwoven, they cannot be treated as standalone systems. Modern science has the inclination to fragment holistic systems for simplification and study the different units separately; this concept also applies to landscape science (Naveh, 1995). Much can be learned in this domain from traditional landscape management systems where nature and society are often one and the same entity, for example, a socially important place or species often also has great ecological significance (Ramakrishnan, 2003). These systems are based on indigenous and local ecological knowledge where knowledge has been acquired over generations through observation and experience. This system of knowledge is dynamic as it adapts with the environment and new experiences (Berkes et al., 1998).

A cultural landscape is created when an area is inhabited or modified by humans. This has a bearing on the biophysical organisation of the landscape where elements are altered due to social, economic, and cultural aspects (Farina, 2000). From the perspective of natural science, people's presence in the landscape and the effect of culture are seen as external drivers, often undesirable and classified as disturbance. However, in the holistic sense, which also includes the perspectives of social sciences, humans' contribution to the landscape is another shaping factor akin to the way that natural forces modify and shape landscapes (Naveh, 1995). Further, humans can be classified as specialists in their environments, where they have altered the existing landscape in order to seek and produce resources. However, seeing that actions are in fact motivated by culture, Naveh labels the global crisis a cultural crisis, which can only be solved through multi-disciplinary and holistic approaches.

Juxtaposed with the effect that humans have had on the landscape, are the effects that the landscape has had on its inhabitants in terms of shaping culture, societal norms, and environmental behaviour. Johnson & Hunn (2010) explore the interaction of local groups with their landscapes in terms of place-naming, the way they interpret patterns, negotiate the land, and utilise its resources. These interactions have defined language, behaviours, and cultures of many groups. The particular perception of place by a given group is significant in finding alternative ways to understand the genius of place, its significance, resources, and best land management practices.

## **2.4 Landscape Management**

In the field of landscape management, land-use allocation and spatial configuration are usually done through a system of landscape and environmental planning. These disciplines concentrate on the biophysical realm investigating elements such as landscape features, processes, and system interactions (Naveh, 1995). The purpose of landscape planning is to systematically and logically allocate land-uses to areas which can support human activity into the future without eroding the resilience of the receiving environment (McHarg, 1971). The term resilience refers to the ability of a system to absorb perturbations without being extensively altered in structure and function (Holling, 1973; Walker et al., 2004). Similarly, Marsh (1998) explains that landscape and environmental planning are used to make decisions about resource use, avoiding environmental degradation and hazard to human life and property. This is done by systematically ensuring that a particular land-use is well suited for its chosen location in terms of biophysical characteristics such as landscape topography, geology, soils, hydrology, climate, and ecological impact.

Generally, landscape and environmental planning give more emphasis to the biophysical attributes of a landscape than to the cultural and socio-political elements. However, the “real” decisions are often made by decision-makers under political constraints rather than directly by technical analysis (Marsh, 1998). Along the same lines, Ndubisi (2002) acknowledges that ecological planning has been far too focused on the natural sciences, often neglecting the social sciences which examine people's relationship with the land in terms of values and attachment. This is thought to have been largely missing in the past due to a lack of a framework combining this information, although new approaches have been emerging in the last two decades (Bastian, 2000; Ndubisi, 2002; Bastian, 2004). A number of these new approaches have focused on governance; for example, Lebel et al. (2006) argue that a combination of meaningful participation, accountable organisations, and decentralised institutions are required for successful governance for resilience. However, the authors briefly ask the question, resilience

for whom? This question touches on the environmental entitlement approach (Leach et al., 1999) where heterogeneous spatio-temporal dimensions of the landscape and associated social systems contribute to skewed access to resources. Disproportionate geographical distribution of resources leads to unequal resource distribution amongst social groups where disadvantaged groups receive a lesser amount of land, often of inferior quality. This situation often develops due to political ecologies where those who have the means acquire the most and best land. Further, the authors provide examples whereby a lack of resource-security contributes to land degradation by subsistence agriculture. This situation arises due to a lack of arable land, whereby disadvantaged groups are forced to cultivate lands with poor soils or steep slopes. Often, this leads to environmental degradation as these practices promote erosion and other undesirable effects. Leach et al. (1999) argue that the appropriate sharing of management responsibilities amongst different stakeholders must begin through a process where conflicts and efficiencies are accounted for as commonly done with multifunctional landscapes.

The multifunctional landscape conceptual framework was developed in the context of European landscapes where a long history of human-dominated landscapes has necessitated in an approach allowing better production as well as other ecological, economic, and social functions (Reyers et al., 2012). A multifunctional landscape is defined as providing a variety of roles which have been usefully categorised as ecological, economic, and social functions (Bastian, 2004; Brandt & Vejre, 2004). Ecological functions refer to flora and fauna habitat, biological properties and related processes of ecosystems (Costanza et al., 1997). Economic functions are also described as productive land-use functions by Brandt & Vejre (2004), referring to the manipulation of the landscape to satisfy a human material need. Social functions relate to non-material needs such as aesthetics, spirituality, political, and legislative functions, manifested largely as a human intangible construction. Brandt and Vejre (2004) identify a minimum of three types of spatial multifunctionality categorised as: 1. Different functions occurring simultaneously on separate portions of the same landscape (spatial segregation); 2. Different functions occurring at different times on the same portion of land (time segregation); and 3. Different functions occurring simultaneously on the same portion of land ("real multifunctionality"). All three types contain interaction between functional units. Specifically, confluence zones of functional units are prone to increased interaction, thus yielding conflicts and synergies (Haaland et al., 2011). The application of this framework to subsistence agriculture landscapes in a developing context has been limited, however, in South Africa this approach is slowly being incorporated into the conservation planning toolbox (Reyers et al., 2012). Despite the increasing acceptance of this framework within the landscape management field, this approach has been

criticised due to a lack of pragmatic planning approaches to establish and evaluate multifunctional landscapes (Reyers et al., 2012).

## **2.5 The Landscape Pattern**

A landscape is composed of different interacting ecosystems, containing both natural and human-made elements which form a pattern throughout the land (Forman & Godron, 1986). The basic landscape feature groups are patches, corridors, and the landscape matrix. The patch is the main building block of the landscape mosaic: a homogeneous entity differing from the external area surrounding the patch. Corridors are long and narrow patches traversing the landscape, whereas the matrix refers to the land surrounding corridors and patches (Forman & Godron, 1986; Farina, 1998; Farina, 2006).

Each landscape has a unique spatial configuration of components, making up a particular landscape pattern and related structure. In this context 'structure' refers to the relationships between the components in terms of their types, spacing, size, distribution, and ecosystem configuration (Forman & Godron, 1986). Patch connectivity and inter-patch connectivity through corridors and stepping-stones are significant for habitat protection and biodiversity conservation (Marsh, 1998; Fischer et al., 2006). Other significant spatial criteria in production landscapes are large contiguous patches of indigenous vegetation to provide connectivity, habitat, and decreased edge effects. Edge effects are a hierarchy of observed differences in biotic and abiotic conditions between the interior of the patch and edges. Similarity in vegetation structure between patches and the matrix, known as low matrix-patch contrast, also contributes to ecological function. For similar reasons, further benefits can be obtained through conservation of different environmental gradients, meaning a diversity of terrain types in terms of features, productivity, and climate (Fischer et al., 2006).

Impacts of geographic (coarse-scale) and structural (fine-scale) fragmentation are also major issues in the provision of an ecologically functional production landscape (Fischer et al., 2006). Geographic fragmentation refers to the breakup of a contiguous patch at the landscape scale, while structural fragmentation refers to the loss of elements at the plant scale, thereby altering the composition of a given patch (Lord & Norton, 1990). These types of fragmentation may impact on the availability of "keystone structures" (Tews et al., 2004), given that these are unique elements in the landscape providing resources or shelter to a variety of species. For example, a hollowed log, providing habitat to specialist species is more likely to be found in the heterogeneous structure of mistbelt forest rather than in a homogenous production landscape.



Unique elements are considered to be “keystone structures” because they are not widely found throughout the landscape. Their presence increases the chance of success of a number of species who depend on these elements for resources or shelter (Tews et al., 2004).

Theory around landscape fragmentation and connectivity is based on the theory of island biogeography which emphasises the importance of large islands and their proximity to the mainland for diversity and endemism (MacArthur & Wilson, 1967). The application of this theory to landscape fragmentation and biodiversity conservation has been debated, although the key principles seem to apply, often observed in landscape fragmentation and its negative effect on vegetation and wildlife populations (Marsh, 1998; Farina, 2006). In production landscapes, riparian corridors are often established as buffers around sensitive areas such as watercourses. These carry the multiple role of providing refugia, habitat, and connective corridors while serving the original purpose of water source protection (Fischer et al., 2006; Mander & Kimmel, 2008). The cumulative implementation of the above landscape pattern attributes is used to secure ecological function and sustained biodiversity in production landscapes (Fischer et al., 2006).

## **2.6 Conclusion**

This broad literature review is testament to the varied approaches examined. The conceptual framework used in this study attempts to combine the inclusive methods of the socio-ecological systems framework while employing the geospatial approach borrowed from landscape ecology and landscape planning. The socio-ecological approach attempts to bridge the technical landscape management framework and the decision-making implications of the landscape governance context in rural South Africa. In this setting, traditional leadership and government represent two separate systems of governance. Due to their different priorities, the landscape planning and management decisions taken by the divergent systems are likely to yield different types of activities. This creates a variety of landscape patches, which in turn form a variety of landscape functions. This literature review has revealed that while the socio-ecological approach has been widely applied to developing world and subsistence agriculture scenarios, the multifunctional landscapes framework seems to have been applied mostly to rural European or North American landscapes. Particularly, it is noteworthy that limited academic material is available on the spatial distribution of land-based livelihoods and specifically their interaction with other adjacent intensive production uses. Nonetheless, this conceptual framework seems to be applicable to contested agrarian landscapes in a developing world context. The multitude of activities and stakeholders operating in a given spatial context and the need for their integration

for a more complete overview provides a good testing ground for the multifunctional landscapes conceptual framework.

Specifically, the Venda landscape is host to a variety of ecological, social, and governance inter-related forces. In order to answer the research question and objectives, the conceptual frameworks outlined above are used: The framework of socio-ecological systems is used to frame the relationship between the ecological state of the study area and its social systems; landscape and land-use planning theory are used as a framework to analyse the existing land-uses in the study area; the conceptual underpinnings of landscape fragmentation, borrowed from landscape ecology, are used to understand and evaluate the connectivity of the landscape, and; the multifunctional landscapes framework is used to combine and analyse the relationships between the different but concurrent land-uses and stakeholders in the subject landscape. To summarise, the reviewed literature reveals that the incorporation of social sciences with natural sciences is not widely covered in the pragmatic landscape planning literature, however these disciplines are brought together under the discourse of multifunctional landscapes. This framework allows a spatial analysis incorporating landscape functions, uses, and stakeholders, therefore appropriate in a landscape planning context.

# Chapter 3: Research Methods

---

## **3.1 Review of Existing Methods**

There are many different ways to analyse the landscape depending on the goal of analysis and information available. Due to the fact that landscape structure – established by landscape composition and configuration – is directly related to landscape function (Forman & Godron, 1986; Ndubisi, 2002), many studies use structure as a way to investigate landscape function and change (Croissant, 2004; Rescia et al., 2008; Tzanopoulos & Vogiatzakis, 2011). Antrop (2000) provides two useful approaches used in this study: the thematic approach and the spatial approach. Furthermore, landscape ethnoecology is used by Johnson & Hunn (2010) in landscape studies by obtaining information directly from local and indigenous communities living in the study area.

The thematic landscape analysis approach was largely advanced by McHarg in 1971. In this approach, layers of the landscape are drafted individually and then overlaid to produce a composite image of the landscape and the interaction between layers. Each layer is a representation of a theme; for example, hydrology, soils, and geology. Planners then use the composite model to make decisions regarding land-use suitability. Some have criticized this method due to its separation of the layers and treatment of each layer as an independent entity, therefore ignoring the principles of landscape ecology (Ndubisi, 2002).

The spatial approach, in contrast, analyses landscapes more holistically (Antrop, 2000). Rather than splitting the landscape into thematic components, landscape units are classified by common characteristics to allow for a spatial analysis of their configuration and interaction with one another. For example, landscape units can be categorised into different classes by grouping areas with similar land cover and topography together. Most spatial approaches require complex GIS manipulation and analysis of raster (imagery-based) data.

While the above methods take a very technical approach to describing and analysing landscapes, the ethnoecological landscape approach is based on anthropological techniques as practised in ethnobotany and ethnoecology (Johnson & Hunn, 2010). This method uses interaction with communities living in the landscape in order to understand how the landscape functions as a socio-ecological system where humans are part of the landscape. Using this method, the researcher explores the landscape through the lens of the community inhabiting

the area. Often relationships are formed with community members before research can be carried out, as this method relies on local and indigenous ecological knowledge to be shared by communities regarding their territories. This approach allows interpretation of the landscape according to the way its inhabitants use and interpret the land rather than through technical analysis (Mark et al., 2010).

Landscape ecology analysis methods can be very specialised, technically complex, and therefore tend to be time consuming, while the anthropology-based approach uses the human lens to understand and analyse landscapes. A gap in the literature exists in using methodology that combines both social and natural science techniques to enable analysis of the socio-ecological landscape. The methods listed below are an exploratory attempt at combining a social and ecological approach.

### **3.2 Study Design**

The main research question of this study deals with the landscape pattern surrounding Thathe Forest in the Venda socio-ecological landscape. However, the sacred site itself was not investigated in the field due to the cultural sensitivities at these special sites. Rather, the approach taken was to investigate the surrounding landscape to explore the geo-spatial context of Thathe Forest. The methods for this study were divided into three groups:

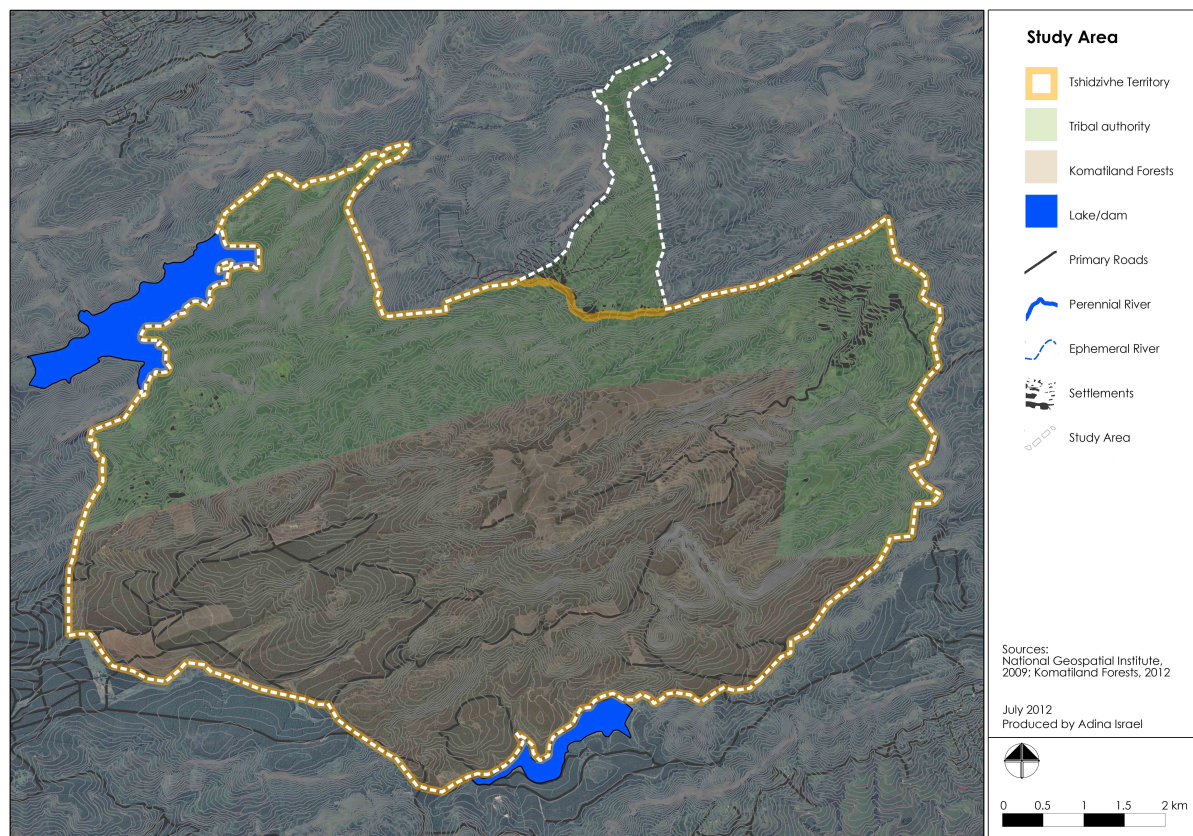
1. Technical landscape analysis comprising thematic analysis and landscape classification (objectives 1 & 2)
2. Landscape ground-truthing investigation comprising guided walks and field interviews (objectives 1,2, 3)
3. Exploration into decision-making through key informant interviews (objective 3)

The first set of methods establishes the spatial relationship between land cover patches and explores the relationship between Thathe Forest and the surrounding landscape. The second set of methods looks at the landscape through the lens of its residents in order to gain an insight as to local people's understanding, their interaction with the landscape, and their perspective of the decision-making systems in place. These methods are also used to ground-truth the landscape ecology analysis described above. The third group is used to gain a general understanding of the Venda landscape and associated decision-making systems. This results in a multi-disciplinary method set from the areas of landscape planning, landscape ecology, GIS analysis, and landscape ethnobotany.

### 3.3 Study Area Selection

The study area is located approximately 10km northwest of the City of Thohoyandou. The area investigated as part of this project was confined to the Thathe Forest watershed (approximately 5,393ha). The study area (Figure 3.1) borders on Lake Fundudzi to the north-west, the Mutale river to the north where it flows out of Lake Fundudzi, the Luwalwamadi river and Tshilungwi road on the north-east boundary, the Tshirovha river to the east and south, the Mukumbani dam to the south, and the Mutale river to the west where it flows into Lake Fundudzi.

This complex cultural landscape was selected due to the cultural biodiversity work and sacred site protection action already being carried out with this community by the Mupo Foundation. The Mupo Foundation approached the University of Cape Town (UCT) with the request of studying the physical landscape conditions around sacred sites. This information complements the eco-cultural participatory mapping exercise conducted by the Mupo Foundation with local community members in 2009. As part of the eco-cultural participatory mapping the local community recorded their indigenous local knowledge related to their territory by reflecting on



**Figure 3.1: The study area boundaries and associated land management authorities.**

the past, documenting the present, and formulating a future vision. This allowed the research project to plug into an existing process while providing the Mupo Foundation and the community with a detailed landscape study to be used in protecting the local environment. Ecologically, the study area encompasses the Thathe Forest watershed, with the sacred forest positioned at the centre of the study area. This ecological delineation is important as Thathe is a major holy forest to the Venda people and water resources have a key importance in the culture (Tshiguvho, 2008).

The study area (Figure 3.1) roughly aligns with the political boundary of Tshidzivhe territory, controlled by Chief Netshidzivhe. About half of the Tshitdzivhe territory has been converted to forestry plantation, forcing most inhabitants to cluster in Tshidzivhe village at the northeast portion of the study area. Other hamlets are found in the northwest portion of the site. Although the area is located only a few kilometres from Thohoyandou, Tshidzivhe is remote due to difficult access. The terrain is mountainous and consists of bushveld and forest dotted with grasslands, rocklands, and cliffs.

### **3.4 Landscape Ground-truthing Investigation**

#### **3.4.1 Community Work Preparation**

Prior to beginning research in the study area, formal consent was sought from the community of Tshidzivhe in a ceremony supported by the Mupo Foundation and makhadzis from different villages around the Thohoyandou area. The project proposal, fieldwork, and implications were presented to the community in an open forum discussion and a meeting with Chief Netshidzivhe. Concerns and questions raised by the community were addressed as part of this process. The ceremony and meeting was facilitated by the Mupo Foundation to ensure that community members understood the purpose of the study, its value, and research activities.

A Research Protocol Agreement (Appendix A) was formulated jointly by the researcher with assistance from the Mupo Foundation. This agreement outlines where and how information can be gathered, how it is to be used, and involvement of community members in the research process.



### 3.4.2 Guided Walks and Field Interviews

Experiential learning through guided walks (Appendix C) was undertaken with community members such as elders, cattle herders, traditional healers, and makhadzis. Guided walks provided an understanding regarding local use of different landscape patches, how land-use patches have evolved over time, and the spatial and functional relationship between different patches. A total of seven walks and one drive were conducted during January and February 2012 (Figure 3.2). These walks ranged from short walks around Tshidzivhe to a very long walk to Lake Fundudzi and a day's drive through the plantation area. The walks ranged in distance from 2km to 25km, whereas the drive was 43km long covering substantial ground within the plantation.

Local translators assisted during walks by translating questions and responses from participants. Field interviews were conducted as informal conversation relating to specific areas being visited and conditions experienced while walking in the landscape. Questions for participants were often prompted by visual cues such as vegetation, landforms, agricultural stands, and soil

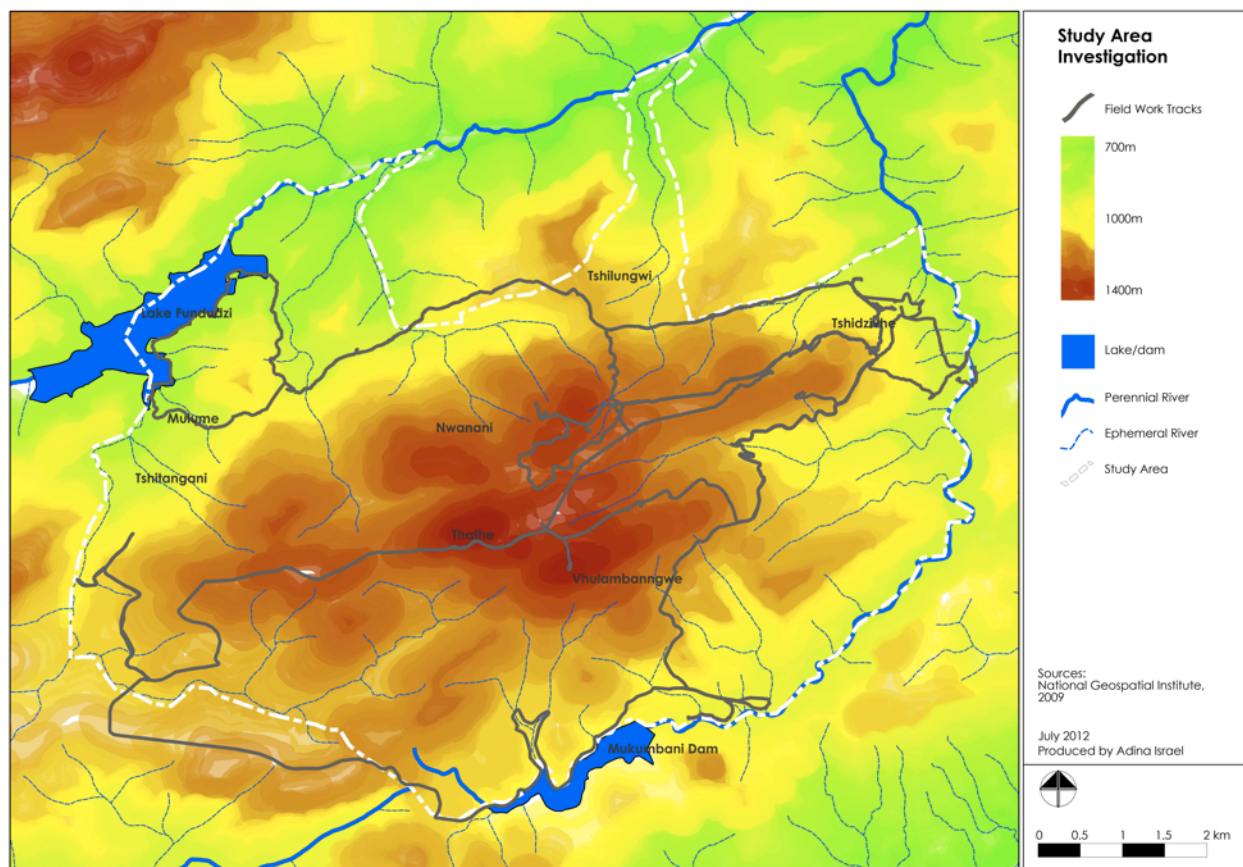


Figure 3.2: GPS tracks of site investigations during fieldwork

conditions. Conspicuous features or features that gave clues regarding changes in the landscape were also investigated. Questions for participants varied depending on their age, occupation, use of the landscape, and area visited. Information was collected through note taking in tandem with geographic positioning system (GPS) points and photographs of locations to provide contextual information. Permission was sought from participants to take pictures of the landscape as well as GPS points. A detailed log of GPS points, observations, and corresponding photographs was recorded to enable ground-truthing through correlation of data to the desktop research using GIS software. Field interviews were not recorded as they were conducted during walks, resulting in poor recording quality.

Information gathered from transect walks was categorised according to land-use and land cover classification. This process produced narratives regarding the stakeholders, vegetation, activities, environmental issues, and conflicts present in each land cover type. Furthermore, this information was contextualised and substantiated with quantitative information and cross-impacts between land cover types were highlighted and discussed. To get an overarching understanding of interactions between landscape functions, an analysis of conflicts and synergies was conducted and discussed by investigating relationships between different functions.

### 3.4.3 Participant Selection

The following criteria were considered during participant selection for guided walks:

a) Landscape knowledge:

Tshidzivhe residents who have spent extended periods of time in the landscape due to their occupation and as a result have developed a refined skill of reading the landscape. Extensive knowledge of the landscape by having travelled to many parts of the Tshidzivhe landscape was also regarded as an important asset.

b) Life experience:

Tshidzivhe residents who have seen ecological and social changes in the study area over the long-term were deemed to have a good understanding of how a variety of factors interact and influence the landscape. Elders and those who have lived in Tshidzivhe for most of their adult life have also explored more of the Tshidzivhe territory therefore have more in-depth knowledge as to the different types of landscapes and the relationship between them.



c) Voluntary participation:

Tshidzivhe residents who regularly volunteered with the Mupo Foundation more easily identified with the project and therefore were willing to volunteer their time. Since participants were not paid for their participation in the project genuine interest in the Mupo Foundation's activities and voluntary participation was required.

### 3.4.4 Site Visit Selection:

The following criteria were considered for areas to visit within the study area:

a) Thorough coverage of a variety of landscapes:

Different parts of the study area have different characteristics depending on landforms, micro-climates, vegetation types, and land-use (ie. human influence). As many parts as possible of the landscape were explored either physically by traversing through them or by visual observation by looking over the landscape from an elevated point. Exploring the landscape was also important in order to observe how people use different places, and how the land cover type and proximity to the village affects the type of activity taking place and associated impacts.

b) Significant areas frequently mentioned by participants:

Areas which were mentioned frequently during interviews due to a unique landscape quality or because they performed a unique function for the villagers were shortlisted as areas to visit.

c) Cultural appropriateness

Given that sacred sites are sensitive cultural locations to be respected and protected, the guided walks did not trespass onto these sites, unless the researcher was explicitly invited to these areas.

d) Time and physical ability of participants:

Due to the research base being Tshidzivhe Village, the starting point for walks was the village itself. Therefore, areas which were easily reachable from the village received more exploration than areas found further afield. Also, time availability, physical ability, and willingness to participate often dictated where the walks would be conducted and for how long.

### **3.5 Key Informant Interviews**

Key informant interviews were conducted to complement the information obtained from guided walks. Interview participants included government officials, academics, plantation managers, and community members. Appendix D lists interview details including date, names of participants, affiliation, and title. Before the start of each interview permission was sought to record the conversation, resulting in voice recordings of most interviews. A list of questions was drafted for each interview depending on the participant's professional position, experience, and existing research gaps (Appendix E). Interviews were semi-structured; conducted as a conversation with pre-defined topics to be discussed listed by the researcher. Most interviewees were identified prior to fieldwork through desktop and internet research, while others were identified by interview participants.

Government officials such as land-use planners and decision-makers were interviewed to gain an understanding into the formal decision-making process existing at the Thulamela Municipality, Vhembe District Municipality, and Province of Limpopo. Questions for decision-makers focused on the planning process, government strategies to address environmental issues in the area, and incorporation of traditional leadership with governmental initiatives. As most government officials did not have intimate knowledge of the study area, questions for this group focused on process and general issues rather than specific issues seen in the Tshidzivhe landscape. Also, former and current academics at the University of Venda that have expertise in the local land-use, landscape planning, and landscape ecology fields were identified and interviewed as to the environmental, social, and logistical planning issues arising from the current decision-making model. Questions regarding effects of current decision-making systems on the socio-ecological landscape, sensitive ecosystems, and sacred sites were discussed with these experts.

Community members, including leaders and elders, and plantation managers were also interviewed. Questions for these participants had a stronger focus on the Tshidzivhe landscape, changes in the landscape, land-use by residents and the commercial plantation, environmental issues facing Tshidzivhe territory, and related decision-making. Most interviews did not require translation. However, interviews conducted with community leaders and community members benefited from translation, as participants were more comfortable conveying ideas in their native tongue.

The information obtained from interviews was consolidated to form an understanding of stakeholders' area of jurisdiction, governance roles, and impacts on features of the landscape,

such as the watershed, sacred sites, and the landscape pattern. In order to analyse this information, various local and regional policies were reviewed and contrasted with the interview information. Answers provided during interviews were also combined with geo-spatial data and field information gathered during transect walks. These different types of information were synthesised to build a broad governance narrative of the landscape integrating technical landscape factors and human dimensions.

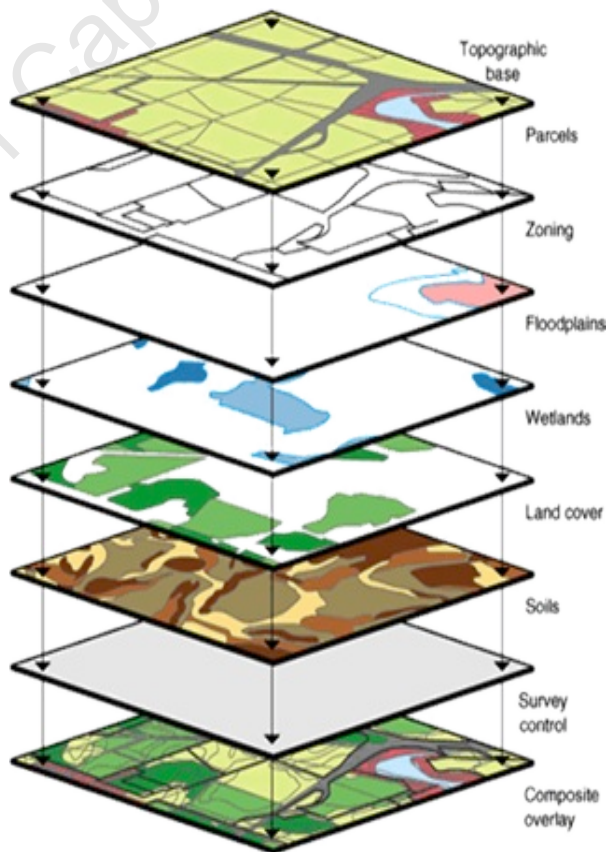
### **3.6 Thematic Layer Mapping**

Thematic layer mapping consisted of dividing the landscape into themes that were then layered to identify areas of interaction between different elements (Figure 3.3). The thematic layering was crucial in providing the physical context of the landscape. The themes selected consisted of geology and soils, gradient, aspect, and hydrology. The layers acquired were in vector (Shapefile) or raster (image) format, compatible with QGIS. Climate and vegetation data was also provided as context to the mapped layers. Appendix B lists the different layers, format type, and sources of data.

#### Geology and Soils:

The main drivers of landscape formation in the long term are geology and climate, therefore an indication of geological conditions provides a wealth of information regarding the landscape (Oberholzer, 2011). Shapefile layers of geological formations and fault lines obtained from the Geoscience Council of South Africa were analysed in terms of their location in the study area and associated soil types.

Soil information is typically a key factor in the existing land cover and land-uses in a given area. However, soil surveys are patchy throughout South Africa unless studies are commissioned privately, usually for development purposes (Oberholzer, 2011). A



**Figure 3.3: Conceptual example of thematic layering**  
(source: ndimensionalgis.com, 2011)

broad soils coverage map, covering all of Southern Africa, was obtained from the International Soil Reference and Information Centre - World Soil Information (FAO & ISRIC, 2011) in ArcInfo native format and then converted to Shapefile to be overlaid with other thematic maps. The broad soil types in the area were evaluated based on their general drainage, stability, fertility, and permeability.

#### Topography:

Topography was a key layer for identifying landforms, hydrology and drainage, gradient, and aspect. These factors in turn have implications for groundcover type and suitability of land-uses. The topography layer was obtained from the National Geo-spatial Institute (NGI) and provides 10m elevation contours. This layer was used to derive the layers listed below:

- a) Gradient: This layer provided information about the steepness of a given area of the landscape, including insight as to physical barriers for land mobility, suitability for different land-uses, and land cover type. This process was done using the QGIS Terrain Analysis slope tool using a digital elevation model (DEM) derived from the topography Shapefile layer. The landscape is categorised into five classes of steepness: 0-5% (less than 1:20), 5-10% (1:20-1:10), 10-20% (1:10-1:4), 20%-50% (1:4-1:2), and over 50% (over 1:2).
- b) Aspect: This layer provides information about the sun exposure of slopes, partially indicating the meso-climate conditions. This layer is derived by categorising the landscape according to direction of slope observed by the elevation contours. The landscape was grouped into four categories by slope aspect: northwest (hottest, afternoon sun), northeast (somewhat hot, morning sun), southeast (cool), southwest (somewhat cool). The aspect layer was obtained by using the DEM which was analysed with the QGIS Terrain Analysis Aspect tool.
- c) Hydrology and Drainage: This layer provides the locations of rivers, water bodies, and watershed boundaries. Drainage corridors were derived manually by identifying areas with sharp concave contours. Ridges were also noted to identify watershed boundaries. Drainage information was complemented by a Shapefile map layer obtained from the National Geo-spatial Institute outlining the inland bodies of water in the study area.

#### Climate:

Context to local climatic conditions was provided through datasets obtained through the Climate Systems Analysis Group (CSAG) at UCT, from a weather station near the study area, the Mukumbani Tea Estate. It was important to gather climate data from a nearby station as climate varies widely with topography in the Soutpansberg. This dataset provided information regarding

minimum and maximum monthly temperatures and total monthly precipitation measured from 1986 to 2010.

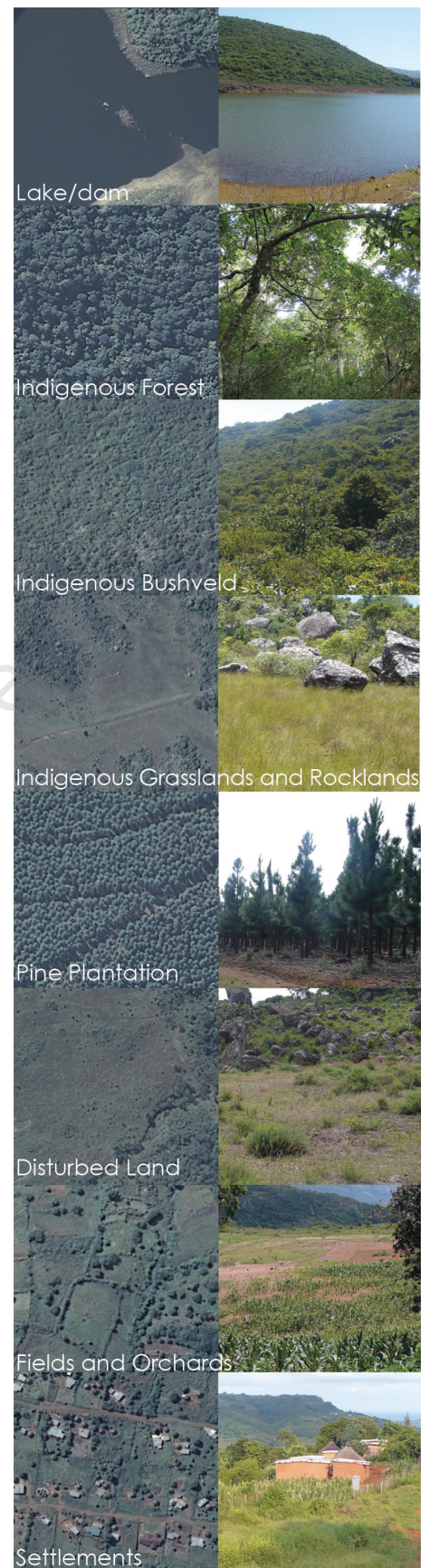
#### Vegetation:

In order to better understand the unique naturally occurring vegetation patches of the study area the main vegetation types were described in terms of their typical location within the landscape and vegetation structure characteristics. This was obtained from the extensive vegetation mapping of South Africa conducted by Mucina and Rutherford (2006).

### **3.7 Landscape Classification**

The landscape classification reflects land cover type and human use of the landscape. Aerial imagery from 2009 was acquired from the National Geo-spatial Institute and classified into land cover patch categories by observation of the colour, texture, shape, and location of land cover at a scale of 1:3,000 to 1:6,000. Identified polygons are a minimum of 1ha in area (10,000m<sup>2</sup>), with the exception of settlement polygons. This was identified as a minimum scale to ensure an appropriate balance between feasibility and adequate detail. The classification was done manually by digitising (digitally tracing) the patches to Shapefile polygons with QGIS software according to the following classifications (Figure 3.4):

1. **Lake/dam:** Areas containing a large still body of water surrounded by land. There are only two such areas along the boundaries of the study area: Lake Fundudzi and Mukumbani Dam.
2. **Indigenous Forest:** Areas exhibiting dense, large, and predominantly indigenous trees with heights between 3-30m and overlapping canopies where grasses are rare (Mucina & Rutherford, 2006). These areas are typically found in the river valleys and on



**Figure 3.4: Landscape classification visual key showing aerial imagery on the right and site photos on the left.**

south-facing cool slopes. *Indigenous Forest* is distinguished from *Indigenous Bushveld* by a coarser broccoli-like texture indicating taller and larger trees. These areas form part of the Forest biome (Mucina & Rutherford, 2006).

3. **Indigenous Bushveld:** Areas with little visible human intervention consisting predominantly of indigenous shrubs and small trees, 0.3-3m in height, and varying in density. Therefore these areas vary widely in their appearance both on the ground and in aerial photography. Dense bushveld can resemble *Indigenous Forest* in aerial photography, however the texture of bushveld is smoother than that of forest. These areas form part of the Savanna biome (Mucina & Rutherford, 2006).
4. **Indigenous Grasslands and Rocklands:** Areas composed mainly of grasses or rocky outcrops forming part of the Grassland biome (Mucina & Rutherford, 2006). These areas are conspicuous in the landscape due to their lack of canopy vegetation, although a few lone trees or shrubs are sometimes found in these areas.
5. **Pine Plantation:** Areas where *Pinus* species are commercially grown, in various stages of their life cycle. Parts of the plantation area can vary greatly due to the different cycles of clearing, planting, growing, and harvesting, however all lands deemed to be in one of the plantation cycles are categorised in this class. Plantation areas form homogeneous forest patterns, different from the more heterogeneous *Indigenous Forest* classification. These areas are also recognised by the numerous forestry roads dividing the pine plantation into compartments. Undergrowth of indigenous vegetation occurs in areas where the pine plantation is in an early stage of the growth cycle, however this is not readily recognised in aerial imagery.
6. **Disturbed Land:** Areas where visual evidence exists that clearing occurred in the recent past. The texture and colour of these areas differ from adjacent *Indigenous Bushveld* or *Indigenous Forest*. These areas are often found around homesteads or in the plantation firebreak area and represent old fields, grazing land, a source for wood, or land cleared for other reasons.
7. **Fields and Orchards:** Areas surrounding homesteads where the presence of cultivated crops such as fields, orchards, or bare soil, sometimes in a rectilinear pattern indicate agriculture activities. These areas were distinguished from *Disturbed Land* by this pattern as other uses such as grazing or harvesting of wild plants occur in heterogeneous patterns. Commercial large-scale agriculture does not exist in the study area.
8. **Settlements:** Areas including homes, structures, and associated courtyards including trees or vegetation adjacent to structures. This also includes community buildings such as schools, and abandoned work camps in the plantation. This is the only classification

where the individual polygons delineated are less than 1ha due to the small size of patches.

Certain rules were applied in order to ensure consistency in categorisation across the landscape. Due to the many roads throughout the study area, these corridors were incorporated into adjacent land cover patches for practical reasons. For example, most roads in the plantation area are very narrow; therefore in most cases they were detected as a break in pine plantation pattern, rather than a visible road. Therefore these were incorporated into the adjacent *Pine Plantation* classification. Similarly, streams and rivers were not visible on aerial photography, therefore their location was obtained from the National Geo-spatial Institute dataset (see Appendix B).

Not all activities can be documented using land cover classification. For example, intensive grazing can be seen in some areas, however grazing in bushveld or forest cannot be detected. Similarly, activities that do not affect land cover significantly, such as food harvesting, cannot be documented by this method. By the same token, the only detectable alien vegetation is the pine plantation due to its texture and colour, however aliens outside the pattern of the plantation cannot be detected due to the heterogeneity of the landscape. Lastly, the classification conveys a snapshot of the study area at one point in time in 2009. Some areas may have changed significantly due to tree felling and fast vegetation growth (van der Waal, pers. comm., January 2012).

### **3.8 Study Limitations**

The above methods are subjected to a number of limitations listed below:

#### Time Limitations

The timeframe for field activities was four weeks. Two weeks were spent interviewing different key informants, and another two weeks were spent at Tshidzivhe village conducting field interviews and guided walks. Given the diversity, complexity, and history of this landscape, the time available to conduct all research activities only allowed brief exploration of areas visited. That said, the information collected from various parts of the landscape resulted in a rich array of information to showcase the different types of landscapes and the interactions between them. However, as this is an exploratory research, further research would likely produce additional findings.



### Data Collection

Due to challenges encountered with the community's ability or willingness to participate in guided walks through the landscape, a small number of participants contributed greatly to the project by sharing their knowledge and experience of the landscape. These participants were drawn upon disproportionately.

Some irregularities were noted such as provision of conflicting information, or information inconsistent with visual clues in the landscape. This was considered as either a difficulty in communication due to language and cultural differences, or at times, perhaps the villagers' desire to get the research activity underway, for example, by providing responses which perhaps they thought were the "right answer". Similar experiences have been documented by Oomen (2005) in the Eastern Cape where a working relationship had to be developed with communities to enable meaningful discussions. Unfortunately, this was not possible due to time constraints in carrying out this project.

### Limited Extent of Areas Explored

Most guided walks took place in the areas surrounding Tshidzivhe due to participant time constraints or physical ability. However, understanding this area allowed the researcher to extrapolate insights gained to other parts of the landscape. Many participants were constrained, as they had to tend to their fields or their cattle during the day, therefore unable to leave their daily duties for long. Elders were usually not able to walk far distances or in difficult terrain due to their physical abilities. Additionally, due to financial constraints the researcher did not have access to a vehicle capable of accessing all roads in the landscape, which would have alleviated some of the above constraints. Nevertheless, guided walks covered all types of the land cover classification.

### Communication Barriers

The native language spoken in Tshidzivhe is Tshivenda. Some residents speak basic English but all conversations were usually conducted in the local language. Although translators were employed for research activities, the full meaning of conversations was sometimes difficult to convey in English either due to the volume of information being conveyed in field interviews or due to the complexity of ideas being conveyed. For this reason, it is possible that some information was lost in translation.



### Mapping Accuracy

Due to the visual method used in obtaining the classification layer, only land cover patches greater than approximately 1ha can be recorded. Additionally, land cover classes can be difficult to distinguish due to similar colour, texture, and shape of patches. However, an advantage of this method over other automated methods is the necessity to manually analyse every recorded polygon to assign it an appropriate class. However, visual classification of the continuum of vegetation types into discrete classes can be considered as subjective.

### **3.9. Synthesis of Qualitative and Quantitative Methods**

The study area was analysed through a number of multi-disciplinary methods. Thematic mapping and landscape classification by land cover type was used to delineate the landscape structure and its contributing characteristics. Transect walks and field interviews were also conducted with community members to gather information regarding subsistence land management. Lastly, interviews were conducted with government officials, forestry managers, and academics to learn how decision-making has affected the structure of the landscape.

While the desktop landscape analysis was used to understand the physical landscape geography, the transect walks with community members were key in ground-truthing these findings. Further, these interactive sessions provided insight as to how subsistence agriculture is impacting the land and explored the livelihood challenges faced by the local community. The landscape conditions and land-use activities experienced during transect walks were related to the desktop study findings of the physical landscape geography and were used to better understand the multiple functions of the landscape. Interviews with government officials, forestry managers, and academics were conducted to explore the broader governance and environmental framework under which landscape stakeholders are operating. This broader understanding was applied to the physical landscape geography and was used to interpret the changes of the landscape and its resulting current pattern. In conclusion, these three types of data were integrated throughout the study, each contributing a different dimension to the understanding of the landscape situation.

# Chapter 4: Results

---

## **4.1 Introduction**

A number of approaches were used to collect observations and compile research results. Firstly, in order to enable description of the landscape structure, the physical geography of the study area was explored using a number of terrain layers including geology and soils, gradient, aspect, and hydrology. These layers largely revealed that the northern and southern parts of the study area differ in geophysical characteristics. Next, a land cover classification was undertaken to investigate the existing land-uses of the study area. This method revealed that bushveld and settlements dominate the northern portion, and commercial pine plantation fragmented by indigenous vegetation dominates the southern portion. Complementary fieldwork and interviews revealed that Thathe Forest is significant for a number of social and ecological reasons. Landscape governance of the subject study area was explored, revealing two main systems of decision-making: the traditional system headed by the village chief, overlapping with local government comprised of Thulamela Municipality, Vhembe District Municipality, and Limpopo Department of Agriculture. Complexities are evident both in the landscape pattern and the decision-making system governing the landscape.

## **4.2 Landscape Structure**

### **4.2.1 Physical Geography of the Study Area**

The study area lies in the Soutpansberg mountain range situated at altitudes ranging between 780m above sea level at the Tshirovha River, and 1440m above sea level at Thathe Mountain. The landscape is mountainous with soils prone to erosion. Hot north-facing slopes are usually covered in bushveld, cooler areas such as shaded river valleys and the south-facing slopes consist of forest, and high areas are dotted with grasslands and rocky outcrops. The climate is subtropical and very dependent on topography (Kabanda, n.d.). The grain of the land runs in an east-west direction, thereby giving major ridges and valleys their orientation. Steep cliffs are usually located on the southern slopes. The area has many peaks and plateaux; however, most notable is the high point at Thathe Forest. Thematic mapping layers consisting of geology and soils, gradient, aspect, and hydrology are provided below to set the physical context of the landscape.

#### 4.2.1.1 Geology and Soils

The geology of the study area (Figure 4.1) is composed of the Soutpansberg Supergroup including mainly the Fundudzi and Wyllie Poort formations. The Fundudzi formation in the south consists of sandstone with basalt sections. To the north, sitting unevenly on the Fundudzi formation is the Wyllies Poort Quartzite formation. Diabase intrusions occur through this formation with an east-west orientation (Brandl, 2002). The soils for the northern and southern areas are known respectively as Lithic Leptosols and Eutric Leptosols (FAO & ISRIC, 2003). These are composed of a rock base with a thin layer of soil, also known as Glenrosa and Mispah soils according to the South African Soil Classification Working Group (1991). The soil in the eastern part of Tshidzivhe, at Tshidzivhe village, does not match this description as it is mostly red clay-loam. This soil is prone to erosion, forming deep ditches (dongas), especially after rainfall. Residents reported the most fertile soils to be found in the thick mistbelt forests where Thathe Forest is located, as well as at the foot of the mountains where sediment from slopes is deposited. The grasslands around Thathe Forest were also endowed with fertile soils as these areas were cultivated before the inception of the pine plantation (Khorombi, 2000).

#### 4.2.1.2 Gradient

The Tshidzivhe landscape is mountainous with very steep slopes prevalent at the northwest and northeast sides of the study area (Figure 4.2). The centre of the study area surrounding Thathe Forest is relatively gentle in slope with grasslands occurring in proximity to Thathe Forest. However, the Forest itself is located on a hill with a steep southern slope.

#### 4.2.1.3 Aspect

The aspect of a given slope partially determines the climatic characteristics of the area. The northern half of the study area is mostly north-facing with many warm and hot slopes, shown as the red and yellow area on Figure 4.3. Contrastingly the southern half of the study area faces mostly south, therefore having many cold and cool areas shown by the blue and green areas on Figure 4.3. It is no surprise that forestry operations are located on the cool, moist, sun-sheltered slopes of this area.

#### 4.2.1.4 Hydrology and Drainage

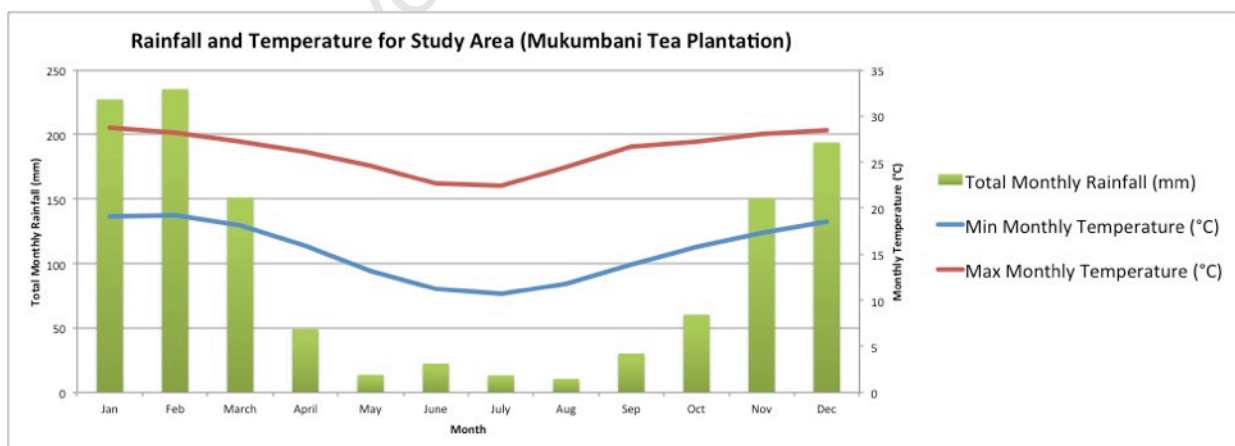
The complex landscape is responsible for the conveyance of water from the high plateaux and mist forests to the Mutale River, downstream of Lake Fundudzi. Counter-intuitively, the southern catchment of Lake Fundudzi consists mostly of the west and southwest areas of the study area, therefore receiving a majority of its water from rivers that have winded through the plantation areas (Figure 4.4). The major perennial rivers consist of the Mutale, the Tshirvovha, and the

Nzhelele rivers, measuring 5-15m in width. Only two major water bodies exist, Lake Fundudzi and Mukumbani Dam. While the former has high spiritual significance amongst the local Venda population (van der Waal, 1997; Khorombi, 2000), the latter is a human-made dam used for irrigation therefore carrying regional economic significance (DWAF, 2004). Community members note that Thathe Forest, as the highest point in the study area, is an important source of water in Tshidzivhe (Elder Aaron & Ramudinqani, pers. comm., January 2012).

#### 4.2.1.5 Climate

The Soutpansberg Mountains and surrounding area have two seasons: a warm wet season (October-March) and a cool dry season (April-September). On average, temperatures range between 13° and 25° in the dry season and 18° to 28° in the wet season (Figure 4.5). The months of January and February are the wettest with about 230mm of precipitation each, whereas the middle of the dry season between May and August experiences a monthly average as little as 15mm (CSAG, 2012).

Due to its mountainous terrain, the study area has many micro-climates, resulting in a variety of habitats and plant communities. Temperatures and precipitation vary widely with topography, where the high lands are cooler and wetter due to adiabatic cooling and orographic precipitation. Wind regularly blows from the southeast in the wet season, bringing clouds and providing more precipitation to southern slopes. These orographic clouds are often present in the morning during the warm wet season, evaporating with sun intensity. During the cool dry season skies are mostly clear with fog forming on high ground (Kabanda, n.d.).



**Figure 4.5: Climatic conditions characterising the study area**



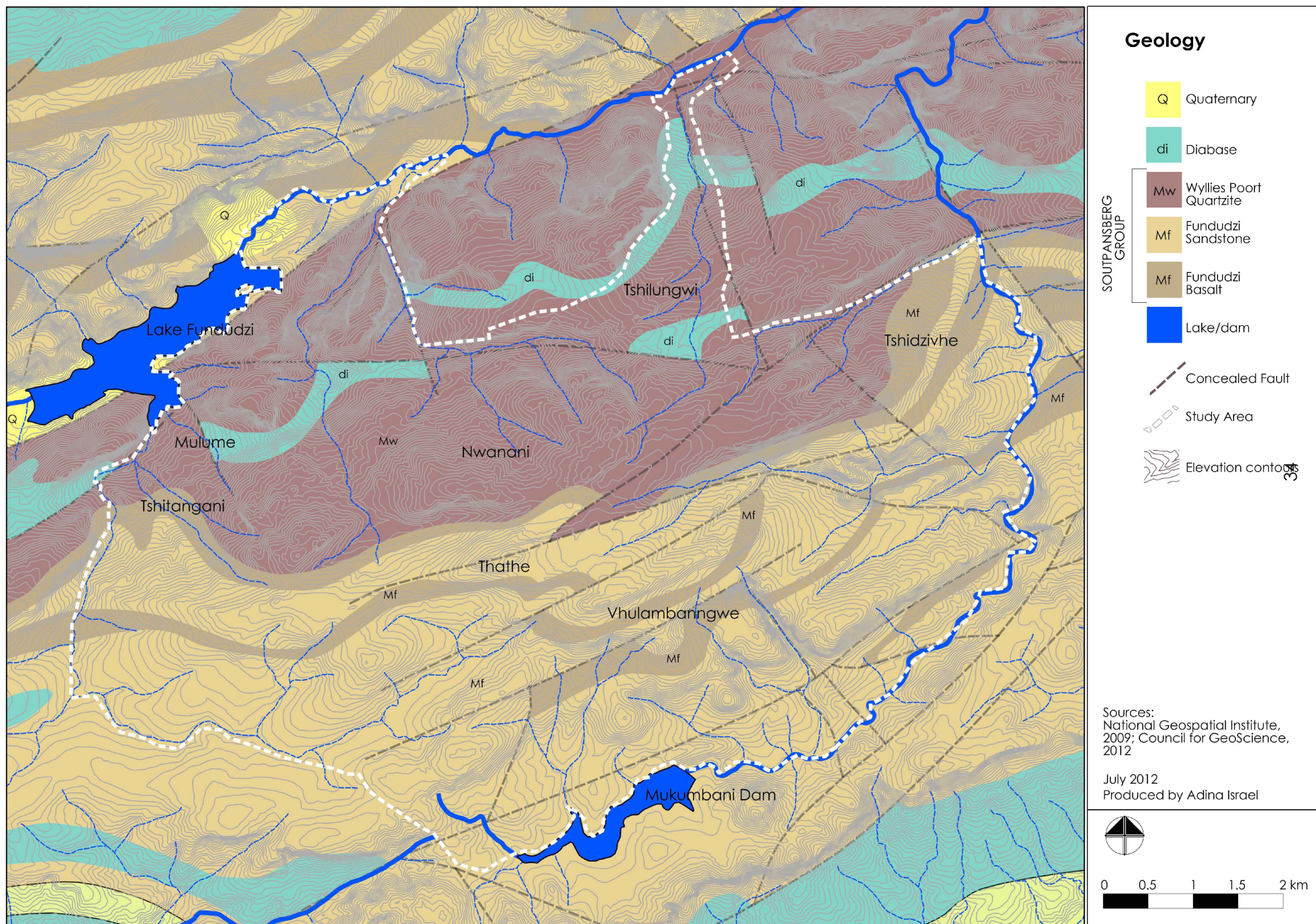


Figure 4.1: Geology of the study area, showing main formations and faults.



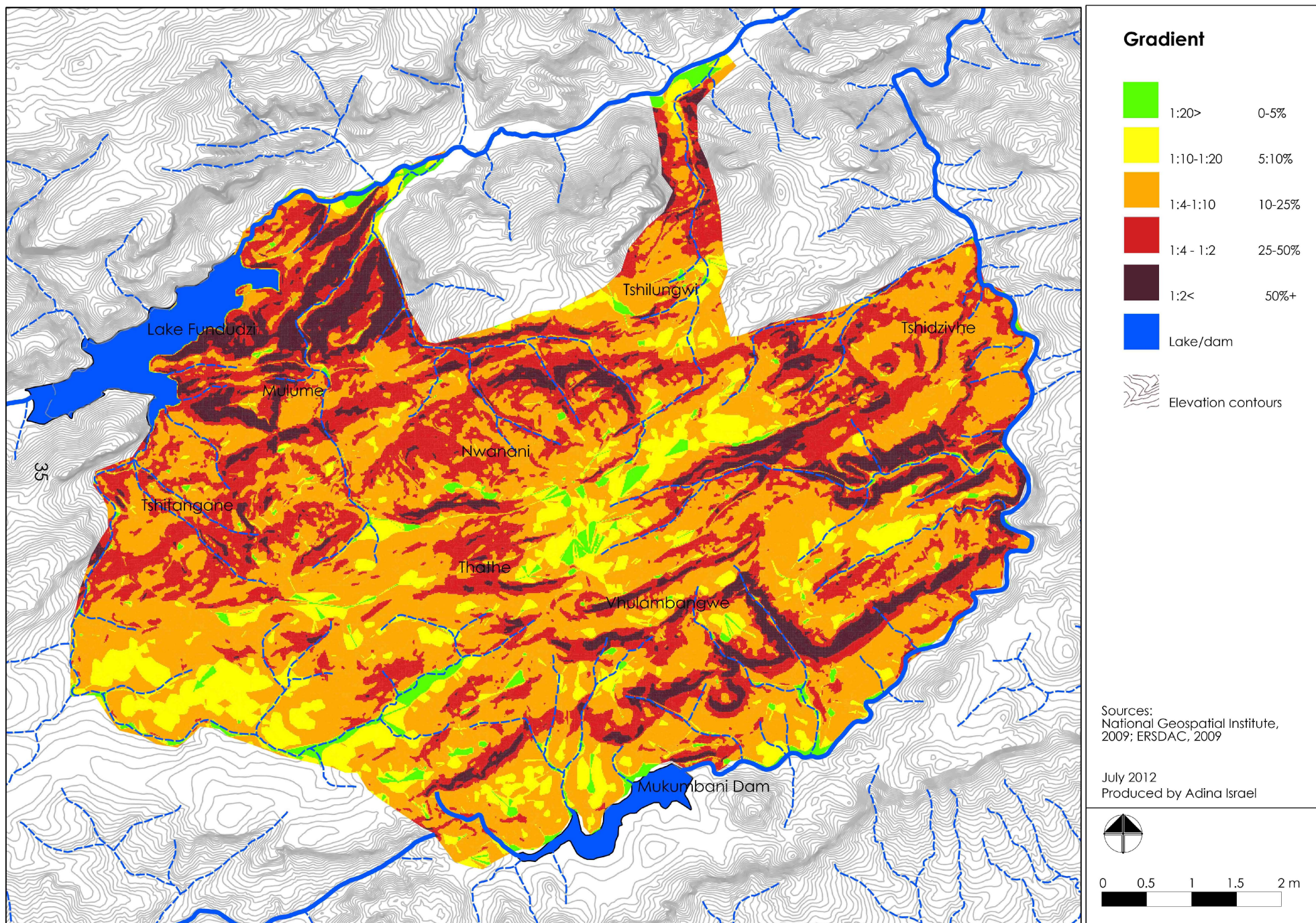


Figure 4.2: Gradient of the study area, showing the degree of steepness of slopes.



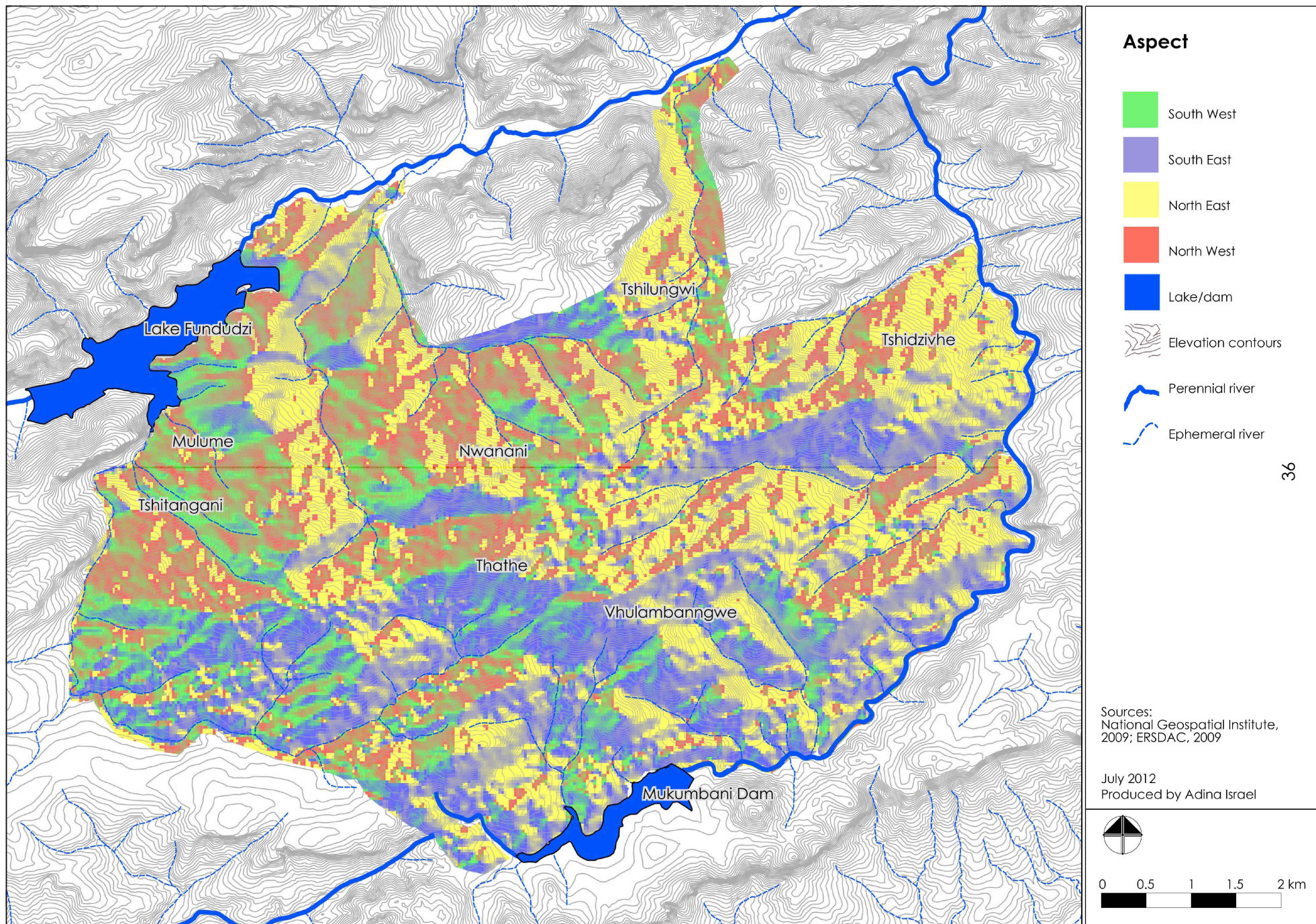


Figure 4.3: Aspect of the study area, showing facing direction of slopes.



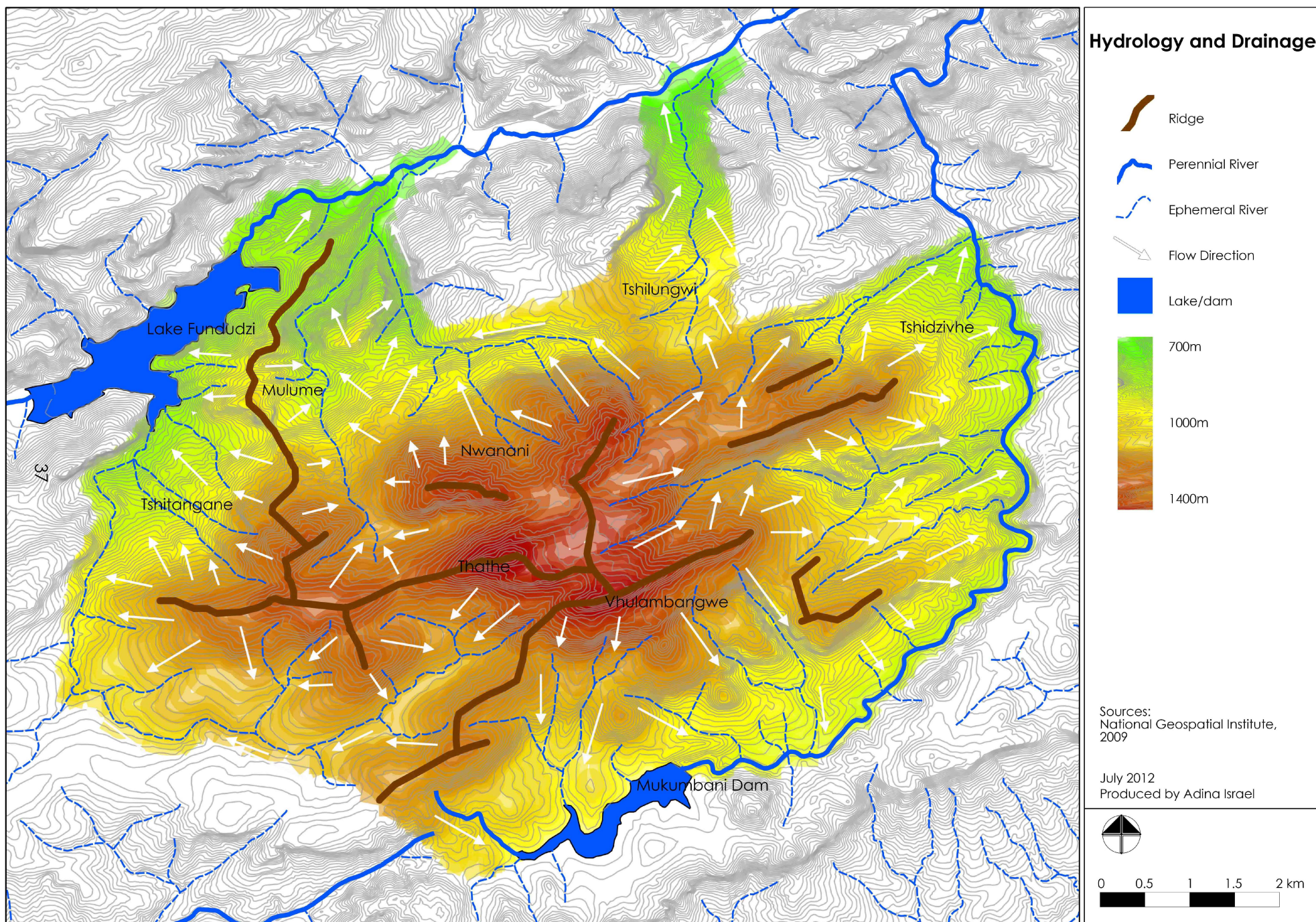


Figure 4.4: Hydrology of the study area, showing direction of water flow, catchments, rivers, and main water bodies.



#### 4.2.1.6 Vegetation Types

The South African National Spatial Biodiversity Assessment (Rouget et al., 2005) provides the context for each biome found in the study area: Forest, Savanna, and Grassland. The Forest biome is the smallest biome in South Africa and it is well protected. However, while most of its vegetation remains (about 94%), a large proportion is critically endangered. Contrastingly, the Savanna biome is the largest South African biome however only 86% of its vegetation remains while less than 9% is protected. The Grassland biome seems to fare the worst out of the three biomes investigated; while the biome contains 30% of South Africa's land area, only 70% of this vegetation remains while less than 2% is protected. Cumulatively, these three biomes constitute about 60% of the country's land area.

The eastern range of the Soutpansberg Mountains is classified into various vegetation types of the Forest, Savanna, and Grassland biomes, resulting in high species diversity and endemism for a small area (Mucina & Rutherford, 2006). The slopes of the study area are dominated by variations of Soutpansberg Mountain Bushveld (Savanna biome) due to the different climatic conditions in the area. This vegetation type is considered vulnerable in terms of its conservation status as only 2% of Soutpansberg Mountain Bushveld is protected while 79% is remaining (Rouget et al., 2005). The southern wet and cool slopes are described as "subtropical moist thickets" and "mistbelt bush clumps"; "savanna sandveld" occupies the middle and some northern slopes of the area; and "arid mountain bushveld" occupies the dry rain shadow of the northern slopes. Other vegetation types occur in other niche areas. Northern Mistbelt Forest (Forest biome) occurs in river valleys and cool, wet, southern slopes. The conservation status of this vegetation type is considered to be least threatened as 11% is protected while 84% is remaining (Rouget et al., 2005). On peaks and plateaux, the Soutpansberg Summit Sourveld (Grassland biome) vegetation type is found. This vegetation grows in and around rocky outcrops and is characterised predominantly by grasses with bush clumps. It is considered to be least threatened as 17% is protected and 99% is remaining (Rouget et al., 2005). Other pockets of vegetation include the Northern Escarpment Afromontane Fynbos (Grassland biome) consisting of fynbos shrubs, considered an outlier in the study area. This vegetation type is listed as least threatened as 56% is protected and 99% is remaining (Rouget et al., 2005).

#### 4.2.2 Study Area Classification

Aerial photography was used to categorise the land cover (Figure 4.6) of the study area into the following classes: indigenous forest, indigenous bushveld, indigenous grasslands and rocklands,

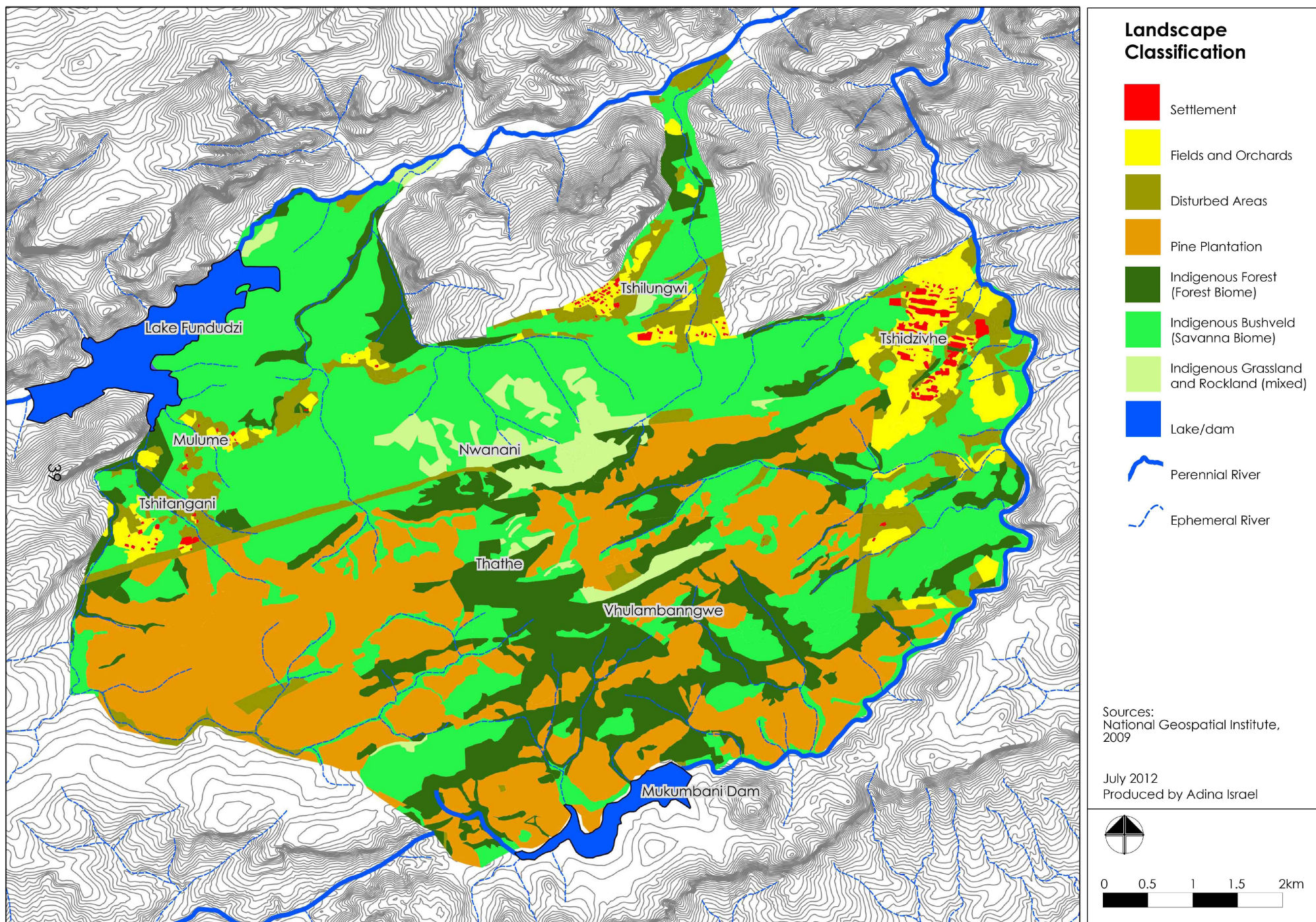
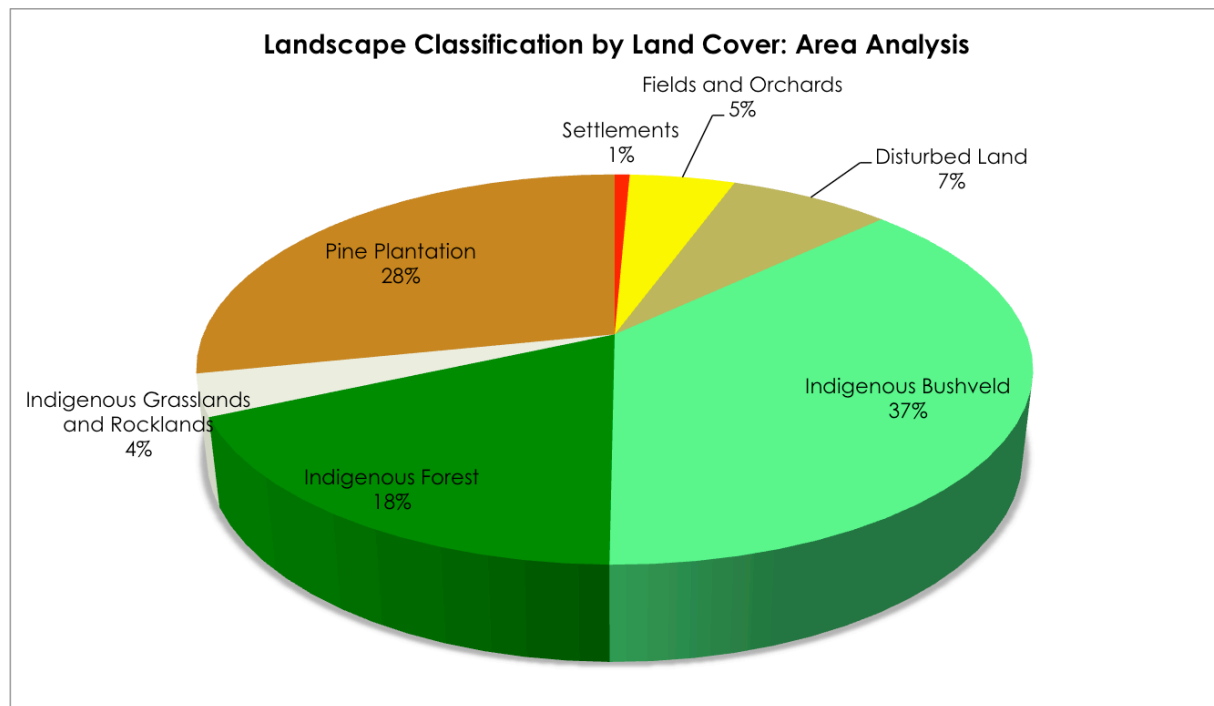


Figure 4.6: Landscape classification of the study area showing land-cover and related land-use.



pine plantation, disturbed land, fields and orchards, and settlements. The area proportions of the different classes is given in Figure 4.7, while the location, visual description, uses, and pattern of each class are discussed below.



**Figure 4.7: Area analysis by classification type**

#### 4.2.2.1 Water Bodies

There are two major water bodies abutting the study area boundaries: Lake Fundudzi and Mukumbani Dam. The latter, at 1,085m above sea level and 54ha in size is the main inception point of the Tshirovha River, capturing water to be diverted to the Luvuvhu catchment for irrigation purposes (DWAF, 2004). As part of a push for increased tourism in the area, an unauthorised tourism lodge has been built adjacent to the dam. Lake Fundudzi is located in the northwest of the study area at an elevation of 860m above sea level and is South Africa's only true inland lake, formed by a landslide over 10,000 years ago (van der Waal, 1997). The Lake is mainly accessible from its southern and western shores, as steep rock faces line the northern shore. Uses on the accessible shores include fishing, cattle grazing, and water harvesting for traditional medicine.

Two major rivers drain into Lake Fundudzi: the Godoni River from the agricultural lands in the west, and the Mutale River from the southern slopes of the Tshidzivhe landscape. A local myth



**Figure 4.8: The northeast extreme of Lake Fundudzi, looking northwest**

tells how the clear Mutale waters never mix with the Godoni River (Dept of Plural Relations and Venda Government Services, 1978). This phenomenon has been explained scientifically by the varying temperatures of the streams (van der Waal, 1997). While the Mutale originates in mountainous terrain and flows through forest and plantation, the Godoni River originates west of Lake Fundudzi and travels through agricultural terraced land, therefore carrying sediment. Due to their different origins, the Godoni water is much warmer and has a brown colour while the Mutale River is cool and clear. Owing to its warmer temperature, the Godoni water rises to the surface, while the Mutale water sinks and finds its way through a subterranean outlet at the eastern end of the Lake (van der Waal, 1997; van der Waal, pers. comm., January 2012). The Lake is however continually shrinking due to sedimentation and water-demanding land uses in its catchment (Khorombi, 2000). As the water has been receding, a thick unvegetated band (5-10m) exists between the water and permanent vegetation line, indicating the high water line (Figure 4.8).

#### 4.2.2.2 Indigenous Forest

The forest classification type (18% of the total study area, see Figure 4.7) predominantly occurs in river valleys and southern slopes. Indigenous forest areas are cool and moist in comparison to other classification types. They are defined by high interlocking canopies of 3-30m water-loving trees, often covering boulders, with substantial amounts of moss and lichen growing on rocks and trees (Figure 4.9). In the local Tshivenda language, parts of this land cover type are known as *daka* (forest), *matalalani* (boulders overgrown by vegetation, Figure 4.10), or *deme* (impenetrable vegetation) depending on landscape features, vegetation density, and accessibility characteristics. Forests are used by the community for harvesting food, medicine, and wood for firewood, carving, tool making, and other uses (Makhadzi, Masuda & Vhiniase, pers. comm., January 2012). Despite the low density of grasses and shrubs in forest areas, a small number of cows grazing were observed in forest land. Community members readily

acknowledge the forests' role in rain generation and water provision. Furthermore, many forest patches are sacred sites serving as burial sites with various taboos contributing to their community-based conservation (Tshiguvho, 2008).



**Figure 4.9: View looking south from Vhulambanngwe hill over Northern Mistbelt Forest (*daka*) to Mukumbani Dam**

In the southern portion of the study area, a large but segmented forest corridor has been retained, although it is largely cut off from other indigenous forest areas. Veins of forest extend into plantation areas, flanking streams and rivers. The forest class occurs on moderate to very steep inclines (10% incline and over), mostly located on southeast and southwest slopes. The difficult terrain in which some forests are found has likely saved them from conversion to pine plantation (Egan, pers. comm., February 2012). Additionally, according to residents, the community requested that many of the remaining forest areas including river valleys and Thathe Forest remain intact when land was cleared for plantation in the 1970s. Most forests are located south and west of Thathe, with Thathe itself being a dense forest. The Forest biome contains a very small proportion of all land in South Africa (0.4%) while 40% of this is critically endangered. However, the remainder 60% is considered to be least threatened, with a relatively high proportion (40%) of the biome considered to be protected (Rouget et al., 2005).



**Figure 4.10: Boulders overgrown by forest (*matalalani*)**



#### 4.2.2.3 Indigenous Bushveld

The indigenous bushveld vegetation classification, belonging to the Savanna biome, is the largest of the classification categories (37%, see Figure 4.7) with the largest contiguous area of land cover occurring in the northern half of the study area with some substantial pockets in the southern half. Bushveld also flanks streams in the plantation area (see also section 4.2.2.5). These corridors and bushveld pockets share edges with Thathe Forest and assist in connecting it to other indigenous vegetation. In the local Tshivenda language, parts of this land cover type are known as *daka* (forest), *deme* (impassable vegetation), or *vuvhu* (bush) depending on vegetation characteristics.

Due to the climatic differences between locations of bushveld pockets and corridors, the composition, diversity, density, and size of vegetation differs dramatically between the different areas of the landscape (Figure 4.11). Where conditions are dry and exposed, shrubs are sparse and small, transitioning to grassland and rocky lands at high elevations. In protected areas on southern slopes, shrubs are dense and large with small trees forming part of the canopy. In these areas, thick bushveld transitions to indigenous forest. Due to the versatility of the bushveld classification, it occurs on all types of slopes. Bushveld areas are regularly used for grazing and plant harvesting for food and medicine, evidenced by smaller trampled or cut back shrubs. Many of these areas are easily accessible, especially adjacent to homesteads, fields, and disturbed land. For this reason they are sometimes cleared in the expansion of crop fields or for the establishment of orchards. This contributes to the current status of the Savanna biome; about 20% of this biome is considered vulnerable, and about 10% is considered endangered. Contrastingly, the remaining 70% is considered least threatened (Rouget et al., 2005).



**Figure 4.11: Bushveld vegetation varies in density and structure between peaks and valleys**

#### 4.2.2.4 Indigenous Grasslands and Rocklands

Indigenous grasslands and rocklands, contained in the Grassland biome, are generally located at the centre of the study area on plateaux and occupy only 4% of the study area (Figure 4.7). Due to similar climatic conditions and appearance of grasslands and rocklands in aerial photography, they have been classified together. These areas are somewhat patchy, occurring in north-south bands at elevations over 1,100m, often with no transition between grassy patches and adjacent vegetation. Some rockland outliers also exist at lower altitudes on very steep rocky



**Figure 4.12: Grasslands (*midavini*) near Nwanani. Note encroaching *Pinus* species**



**Figure 4.13: Rocklands (*gwara*) near Nwanani**

slopes. Grasslands and wetlands associated with the Soutpansberg Summit Sourveld occur in level areas at tops of plateaux (Figure 4.12), while rocky outcrops sometimes have shrubs and small trees growing amongst them, associated with the Northern Escarpment Afromontane Fynbos (Rutherford & Mucina, 2006). Other rocky areas are composed of continuous horizontal rock faces or some very steep rock-face slopes. In Tshivenda, grasslands are known as *midavini* and rocklands are called *gwara* (Figure 4.13). Many grasslands and rocklands occur north of Thathe Forest, separated by forest, bushveld, and plantation. Historically, there were many large patches of grassland in the area east of Thathe, currently occupied by pine plantation (Khorombi, 2000; Ligavha-Mbelengwa, pers. comm., January 2012; Ramudingani & Elder Aaron, pers. comm., February 2012).

While some types of grasslands are used for grazing on a regular basis, others are only used in winter when the preferred rangelands are unavailable. For example, during the period of research fieldwork in January and February, grasses on the high plateaux near Nwanani were mostly intact, while other grasses in lower elevations were heavily grazed. Grasses on the high

plateaux are grazed in winter when they are dry and all other grazing areas are depleted. According to Komatiland's Environmental Officer, the number of cattle and frequency of grazing often exceeds what the land can sustain in Venda. Concern has been expressed regarding grazing practices in grasslands due to degradation and impacts on rare endangered species, such as *Aloe vosii* (Egan, pers. comm., February 2012). Conversely, alien invasive pine trees have been observed in grasslands and rocklands. The suitability of the Grassland biome to various agricultural activities is evident by the relatively low proportion of remaining vegetation and the extremely low proportion of protected areas (Rouget et al., 2005).

Rocklands have not been impacted by anthropogenic activities due to their difficult accessibility and infertile terrain. Many of these areas are difficult to traverse due to high non-contiguous boulders and thick shrubs. These areas contain plants for crafts and traditional building materials, although these materials do not have a major role in current day-to-day Venda livelihoods.

#### 4.2.2.5 Plantation

The Komatiland pine plantation is found in the southern half of the landscape, making up 28% of the study area (Figure 4.7). The plantation area is roughly divided into two pockets: a cohesive western pocket and a fragmented eastern pocket. In between the two forestry pockets lies Thathe Forest along with other indigenous vegetation areas forming a north-south corridor (Figure 4.14).



**Figure 4.14: Thathe Forest surrounded by young plantation compartments (looking northwest from Vhulmbanngwe hill)**

Throughout the plantation many indigenous vegetation veins along watercourses further fragment these areas. In line with the existing wetland delineation policies (DWAF, 2005), after compartments are clear-cut, wetland buffers are set as conservation corridors before a new generation of pine is planted (Egan, pers. comm., February 2012). Generally speaking, buffer



areas span a minimum of 20m from the permanent wet zone in perennial rivers, while wetland areas (Figure 4.15) and non-perennial rivers are analysed according to hydrology, soil morphology, and vegetation composition (DWAF, 2005). Regeneration of these areas is monitored by Komatiland on a regular basis. Weed control is a main challenge, with pine encroachment into indigenous areas being a key concern (Egan, pers. comm., February 2012).



**Figure 4.15: Indigenous vegetation reclaiming former wetland which was turned into a plantation compartment**

The quantity of water absorbed by the pine plantation is unknown as no research has been undertaken to empirically establish this (Egan, Ligavha-Mbelengwa, and van der Waal, pers. comm., January & February, 2012), but many different descriptive accounts paint an alarming picture. In an interview, Ben van der Waal, who has worked as a limnologist in this area for over 20 years, described the sudden appearance of springs on plantation roads after clear felling of pine trees in that area. The volume of water emerging out of the ground was substantial enough to flood the road. Van der Waal explained this event as evidence of the copious water uptake by the pine trees. In terms of water quality, community members have in almost all cases stated that water quality has not changed since the inception of the plantation. Komatiland has indicated that the greatest water quality challenges lie in controlling sedimentation caused by plantation access roads. Annual water quality assessments in the form of bio-monitoring and diatom (algae) studies are conducted to ensure water is fit for consumption by villages downstream (Egan, pers. comm., February 2012).

Access roads delineating forestry compartments occur throughout the plantation and form many edges and corridors (see Figure 5.3), varying widely in their groundcover, width, and traffic. Some roads are gravelled and regularly used for plantation operations and to access villages, while others have been inactive for years. Most roads are detected only as a line between compartments in aerial photography. Due to the difficulties inherent in classification, roads have been included into the broader plantation classification area.



**Figure 4.16: Pine plantation with a remnant indigenous forest flanking a river valley, winding forestry roads, and firebreak (looking south from a ridge west of Tshidzivhe village)**

Due to the establishment of forestry roads and clear-cutting practices, the plantation is a key contributor to the erosion and sedimentation of local watercourses. During the establishment of the plantation, all types of terrain where pine (and some eucalyptus) could be planted were converted, including riverbanks, wetlands, and very steep slopes. Planted compartments range from flatter areas to steep slopes of up to 58% incline. The plantation was established prior to any environmental regulations or regard for local culture, converting many areas that would now be protected under current legislation. According to the Komatiland Environmental Officer, the plantation operates on historical licenses without the ability to acquire new licenses in the area, therefore continually losing portions of plantation compartments to wetland buffers without acquiring new land in the area (Egan, pers. comm., February 2012). Vital areas were negotiated by the local people to remain undisturbed as they represent important cultural and religious sites, including gravesites, the Holy Forest, and other natural features with cultural importance. For example, the indigenous forest valley, shown in Figure 4.16, is said to have been retained as a result of negotiations between local people and representatives of the plantation (Tshidzivhe makhadzis, pers. comm., February 2012). However, the context and dynamics of these negotiations remains unclear. Currently, sacred sites are not actively managed by Komatiland Forests, but are recognised as Special Interest Areas in the management plan for this area (Egan, pers. comm., February 2012).

Historically, most areas occupied by the plantation were once indigenous grassland, bushveld, or forest, though current micro-climatic conditions in plantation areas are vastly different. Plantation areas are hot and dry, with some undergrowth in young compartments, but almost none in mature compartments. These areas lack the diversity of plants and insects found in the indigenous vegetation areas. The latter are rich in groundcover to protect soil and retain

moisture, with canopies providing cool shelter from the sun. A survey of the Tshivenda names given to areas now found within the plantation contributes to evidence of decreased biodiversity as certain places carry wildlife names due to the species that once roamed those areas (Ramudinqani & Elder Aaron, pers. comm., February 2012). Names such as *Lanari* (buffalo), *Lwangululu* (plentiful mountain goats), and *Vhulambanngwe* (leopard place), are testimony to the wildlife that once existed in this landscape but have since disappeared.

Apart from commercial timber use, activities such as grazing (Egan, pers. comm., February 2012) and harvesting food and medicine (Elder Aaron, pers. comm., January 2012) take place in plantation areas (van der Waal, pers. comm., January 2012). In interviews, residents indicated pine trees have no use to them as they are not suitable for firewood. Residents did not believe that they receive any direct benefits from the plantation and therefore are generally unhappy about its establishment on their ancestral lands.

#### 4.2.2.6 Disturbed Land

The disturbed land classification usually occurs on the periphery of fields and settlements (Figure 4.17), consisting of 7% of the total study area (Figure 4.7). These lands consist of old fields, where land is allowed to rest as part of the crop rotation schedule (Ramudinqani, pers. comm., January 2012); bushveld or grassland that is used heavily for grazing due to its proximity to homesteads;



**Figure 4.17: A grazing pasture forming part of the disturbed land classification**

and areas where indigenous vegetation is regularly cut back such as the plantation firebreak area. As a result, these lands are generally fertile and not very rocky. Clues such as their location, browsed and harvested shrubs, short grasses, and large amounts of cow dung observed in the field were used to confirm these areas as part of this classification. Like settlements, surrounding disturbed areas are located a distance of a few kilometres from Thathe Forest. The closest disturbed area to Thathe is the firebreak which crosses the study area from west to east. In some



areas the firebreak has been haphazardly converted to other land-uses through encroachment by fields and homesteads.

#### 4.2.2.7 Fields and Orchards

This classification category includes subsistence to small-scale commercial crop fields and orchards (Figure 4.18), and consists of 5% of the study area (Figure 4.7). These consist of a variety of wild leafy vegetables, sweet potato, and varieties of local squash, inter-planted with maize as an important staple. Fields are managed on a three to four year rotation (Ramudinqani, pers. comm., January 2012). Maize crops are usually planted in summer where some residents use a purchased seed yielding crops in three months, as opposed to the traditional variety, which takes six months (Netshidzivhe, pers. comm. February 2012). After harvest in May, fields are available for cattle grazing during winter, thereafter the cattle return to their grazing ranges.



**Figure 4.18: Fields and crops surrounding a homestead in the Mulume area**

Fields are typically located around homesteads, although in the recent past, new fields have been established far from residents' homes due to increased demand in land for cultivation (Tshidzivhe elders & makhadzis, pers. comm., January 2012). These new fields seem to be much larger than traditional fields around homesteads, thereby allowing some farmers to sell surplus yields. An example of these fields exists at the western edge of Tshidzivhe close to the western forest, where about ten years ago the forest area was cleared for new maize fields on a slope gradient of 14-38%, partly planted between boulders (Figure 4.19). The reason for expansion given by the community is the shortage in available land for cultivation coupled with a growing population. Additionally, in the past, the Netshidzivhe clan inhabited the high plateaux, which were relatively flat and therefore better suited for ploughing. Forced removals have constrained the community to locate their fields in steep land and expand them when needed on even steeper land. The western and northern parts of the study area include cultivated fields and

orchards on sloped lands. However, fields in Mulume and parts of Tshilungwi are located on a moderate incline due to the settlements' location on level land.



**Figure 4.19: Maize planted on a slope amongst boulders.**

#### 4.2.2.8 Settlements

Homes and adjacent yards have been classified as settlements (Figure 4.20). Homesteads are small areas of land including the home and an immediate area outside the home cleared of all vegetation and sometimes delineated with a short wall structure. In some cases a number of trees are planted outside the wall, for shade and sometimes including fruit such as mango, avocado, banana or other culturally important trees or shrubs used for medicinal purposes. The fields are usually located just outside this area.



**Figure 4.20: Homesteads in the southeast area of Tshidzivhe**

Four settlements exist in the study area: Tshilungwi on a northern escarpment, straddling the study area boundary, lying outside Tshidzivhe territory; Tshidzivhe village at the extreme northeast, having the highest number of residents densely clustered together on steep slopes; Mulume, consisting of a few homesteads on mildly sloping land in a central valley; and Tshitangani in the northwest, a low-density settlement situated on hot west-facing slopes. Due to the location of the settlements on the periphery of the territory, Thathe Forest is located far from

community members. This results in Thathe Forest being relatively remote, as most village dwellers do not own vehicles.

Despite being under the control of different chiefs, Tshidzivhe and Tshilungwi residents are closely connected as the villages are closely located and linked by a good road. On the other hand, Mulume and Tshitangani villages, governed as part of the Tshidzivhe territory are quite disconnected from Tshidzivhe village due to the long distance between them, lack of roads, and inaccessible landscape. For this reason, these areas have their own headmen to tend to local issues.

#### 4.2.3 The Roles of Thathe Forest

Thathe Forest has three key roles in its socio-ecological landscape: It is the spiritual centre of the Netshidzivhe clan (Dept of Plural Relations and Venda Government Services, 1978), it is a focal part of an ecological corridor, and it is the water source for a large watershed.

##### 4.2.3.1 Place of Worship

Thathe Forest is the resting place of the powerful Chief Ne-Thathe and all of his ancestors (Dept of Plural Relations and Venda Government Services, 1978; Netshidzivhe, pers. comm., February 2012) and as such it is considered locally to be a Holy Forest. Amongst other legends, the Tshidzivhe clan believe that a white lion lives within the forest and protects it (Dept of Plural Relations and Venda Government Services, 1978). Thathe has been described as the "altar of a church" (Ecologist, 2011) and is located in the highest area at the centre of the Tshidzivhe territory (see Figure 4.4). Cultural rituals are conducted for a variety of occasions, including burials (of the bones of the chiefs only), strengthening the community's social ties, and spiritual needs. Due to their strong belief in Thathe Forest, the community negotiated for the protection of the Forest during establishment of the plantation.

##### 4.2.3.2 Ecological Pocket

Thathe Forest is part of an important ecological corridor, acting as a connector between indigenous vegetation in the north and south parts of the study area. It is one of the few remaining large pockets of Northern Mistbelt Forest in the Tshidzivhe landscape, and is relatively intact due to associated strong cultural beliefs. Owing to the abrupt natural and anthropogenic changes in vegetation types, Thathe Forest connects to all three indigenous classification types: adjacent forest areas, bushveld, and grasslands and rocklands. However, it is located in the centre of a corridor with plantation pockets to the east and west. To the south, this corridor is blocked by plantation lands, which separate it from the remainder of the landscape. This

landscape configuration may support smaller organisms such as insects, but larger wildlife that once roamed these areas are no longer found here (Ramudinqani & Elder Aaron, pers. comm., February 2012).

#### 4.2.3.3 Water Source

Due to its elevated position in the landscape and the rich mistbelt forest canopy, Thathe Forest is said to generate water for the Tshidzivhe landscape. Tshidzivhe village has abundant water supply as plastic pipes traversing the village are tapped into springs and deliver uncapped water to the entire village. Contrasting to the surrounding dry savanna, water generation in this landscape has two main sources: cloud generation by forest canopy and orographic clouds. Clouds are generated by perspiration from canopy leaves and eventually turn into precipitation. Due to clearing of the mistbelt forest and its replacement with pine trees, this type of water accumulation would have been much greater in the past (Ataroff & Rada, 2000). This has been confirmed through interviews with Tshidzivhe elders (Ramudinqani & Elder Aaron, pers. comm., February 2012) and a limnology expert (van der Waal, pers. comm., January 2012). The second source consists of orographic clouds pushed by southeast winds, which are responsible for greater precipitation at high elevations. Due to the complex topography of the study area, the water draining from high elevations does not simply go downhill, but circles the landscape (see Figure 4.4). Tributaries eventually feed the perennial rivers of this territory, marking its boundaries.

#### 4.2.4 The Overall Landscape Pattern

Based on these results, the most evident characteristic is the fragmentation of the landscape. The northern half of the study area has a very different fragmentation pattern from the southern half. Due to subsistence activities in the northern area, land fragments are relatively small and clustered together, leaving a large, ecologically viable patch in the centre with human activities occurring at the periphery. This indigenous bushveld area forms the matrix of this area. The opposite is true for the southern portion, where the commercial forestry compartments are large and non-contiguous leaving many indigenous vegetation fragments between them. Transition between different plantation patches and indigenous vegetation patches is very abrupt, as this area is continually managed to keep each vegetation type within its own boundaries. Disturbance by the pine plantation has transformed the landscape to such an extent that the forestry compartments form the matrix for a large part of the southern area. No consideration was given to the new landscape structure created by the pine plantation or its resulting landscape ecology. Future research is required to investigate the ecology of forestry access roads and their roles and impacts as ecological edges and corridors.

With respect to indigenous vegetation patches, the larger the patch, the greater its ability to support high biodiversity due to decreased edge effects and improved connectivity to other nodes and the rest of the landscape (Fischer et al., 2006). Landscape connectivity, particularly throughout the remaining indigenous vegetation, is important for biodiversity conservation as poor connectivity is partly responsible for decline in species populations (see Ch. 2). It can therefore be concluded that the small indigenous vegetation patches with few links to other indigenous vegetation are poor supporters of biodiversity, while large well-connected nodes likely hold the highest biodiversity in the study area.

### **4.3 Land-use Governance**

#### **4.3.1 Ecology and Governance**

Due to the favourable production potential on the southern portion of the landscape, namely greater precipitation, shade protection, productive soil, and gentle slopes, this part of the landscape attracted forestry development interest. This created a complex situation whereby local people who have inhabited the landscape for centuries were forcibly removed from their ancestral lands (Lahiff, 2000; Tshiguvho, 2008; Netshidzivhe, pers. comm., February 2012). Many elder community members carry bitter memories of forced relocations. Edward Mabogo, former Venda resident and ethnobotany expert, provided a deep cultural explanation of the meaning of forced removals: *"The establishment of the plantation violated rules about the place, as it forced people to leave behind the sacred sites and forest... ownership of property [is] very much connected to land...recognized even by God that this is their place"* (pers. comm., January 2012). This concept is extended to local people's management of the environment for generations, ultimately resulting in indigenous and local conservation systems applied to forests, bushveld, and all other natural resources found in the land such as firewood, mushrooms, locusts, and grazing areas (Mabogo, pers. comm., January 2012).

As the southern portion of the landscape was initially appropriated by the South African Department of Forestry and then transferred to the Venda Department of Agriculture and Forestry, profound landscape change occurred where grasslands and forest areas were transformed to pine plantation. Correspondingly, traditional governance of this area was exchanged for control by government departments. Therefore the transformation prompted by different geological and climatic conditions in the landscape has affected not only land cover and land-uses, but ultimately, along with contributing economic and political circumstances (Lahiff, 2000) brought about the takeover of the southern portion of the landscape by a new



form of governance. Due to its forced entry into the landscape, the new governance structure has been at odds with local people and existing traditional leadership for decades (Mabogo, pers. comm., January 2012). Because of these historic events, the landscape is divided into two separate governance units, where decision-making processes are made by different bodies for different parts of the landscape with little communication between these stakeholders.

#### 4.3.2 Parallel Governance Systems: Traditional Leadership and Government

Governance in the study area occurs through a joint traditional chieftaincy and government system. These two systems operate mostly apart from one another, influencing the landscape at different scales and in different ways. These separate systems developed as a result of government interests in the production potential of the southern slopes of the study area starting in the 1940s, leading to a land grab from local people. According to Mabogo, Director of Environmental Research at Limpopo Economic Development, Environment and Tourism (LEDET), due to historical events, such as forced relocations, chiefs do not generally recognize decisions made by governmental bodies. They follow traditional rules and consider the land as belonging to them. Many chiefs are connected to government only in their registration. However, this trend is broken when traditional leaders have social connections to (or are themselves embedded in) government systems. Governmental bodies are aware of the dissociation between the two systems, and have tried to involve traditional leaders with minimal success (Mabogo, pers. comm., January 2012).

The root of the problem seems to go to conflicts between the two ownership systems, traditional and governmental (Mabogo, pers. comm., January 2012). There are two main types of land ownership in Venda: private land ownership where the owner has a deed bearing her/his name and traditional land ownership where the land is held in trust by a traditional leader (Livhebe, pers. comm., February 2012; Lahiff, 2000). In the case of Tshidzivhe, the land is held in trust by the Tshivhase Traditional Council, with Thovhele Kennedy Tshivhase as the high chief and Chief Netshidzivhe acting as headman. However, officially, the land belongs to the Minister of Rural Development and Land Reform. Highlighting the tensions related to ownership, one government official specified that "you don't want to make people angry... so you don't say this, you just say it is their land." (anon., pers. comm., February 2012). The conflict between traditional leaders and government hinges on the notion that both parties believe they are the rightful decision-making authority for the land. This creates a conflict between traditional leadership, civic organisations, and the municipalities (Mabogo, pers. comm., January 2012).

### 4.3.3 Government

A number of government officials from Thulamela Municipality, Vhembe District Municipality, LEDET, and the Limpopo Department of Agriculture were interviewed to obtain information regarding government involvement and land-use policies affecting the study area (Appendix D). Most government officials interviewed have never been to Tshidzivhe nor did they seem familiar with the village's location or environmental conditions. While the two municipalities reportedly have different responsibilities, the officials interviewed at both government offices struggled to explain exactly how their responsibilities vary, other than broadly by scale from regional to local.

In terms of environmental policies and land-use, Thulamela Municipality officials specified they do not deal with rural land-use and environmental issues, but rather receive policies to be implemented from higher levels of government. The Thulamela Planning Department is in the process of commissioning planning studies for various nodes (growth points), which will assign future land-use designations to various areas throughout the municipality. These plans are drafted by an external consultant involving residents through public consultation (Maluleke, pers. comm., January 2012). Tshidzivhe is classified as a third order settlement, and is therefore accorded lowest priority in terms of planning, meaning it will be amongst the last nodes to be addressed. Mr. Maluleke, Head of the Thulamela Municipality Planning Department, explained that this is due to Tshidzivhe's low and declining population because of residents leaving the area (pers. comm., January 2012). According to the Integrated Development Plan, third order settlements are remotely located in the traditional rural areas with a minimum population of 5,000 residents. These areas have some development potential based on service provision and population growth, however they have inadequate economic opportunities (Thulamela Municipality, 2010).

A rural land-use plan was not possible to locate, however the Vhembe District Municipality Integrated Environmental Management Plan (IEMP) deals broadly with various environmental issues facing the area. The IEMP includes main decision-making stakeholders and possible solutions for environmental issues. Amongst others, the issues tackled in the IEMP include biodiversity protection, soil erosion, poaching, deforestation, water pollution, and waste management (VDM, 2009). However, the plan does not include any spatially explicit information for any particular area, treating the diverse Vhembe District Municipality landscape uniformly. As an indication of the lack of coordination, the Thulamela Planning Department was aware that

an IEMP exists, but despite the node intensification process affecting numerous rural areas, Thulamela Municipality officials were not aware of IEMP policies or where to source a copy.

Thulamela, Vhembe, and provincial officials have indicated that any project being carried out in a tribal-controlled area must receive consent from the local chief in consultation with the Provincial Departments of Environment and Agriculture (Maluleke, pers. comm., January 2012). Contrastingly, traditional leaders are not listed as role players in mitigation of environmental issues in the IEMP (VDM, 2009). The IEMP identifies role players as municipal officials, environmental affairs officials, and the public; the emphasis is on government control through policies, inspections, and enforcement. However, in discussions with government officials from all levels, traditional leaders are nearly always mentioned as stakeholders. This is further noted in the Thulamela 2008-2009 Integrated Development Plan (IDP) whereby a Mayoral and Traditional Leadership Forum exists to allow for information exchange between traditional leaders and political leadership regarding service delivery (Thulamela Municipality, 2010).

#### 4.3.4 Traditional Leadership

In the Tshidzivhe territory, Chief Netshidzivhe is acting as headman under Chief Tshivhase. Therefore all matters relevant to the Tshidzivhe territory are by default delegated to Chief Netshidzivhe. Every two weeks a community meeting is held whereby residents voice concerns and disputes are handled. In principle, residents seek permission for various land and resource related activities such as occupation of land for settlement, cultivation, grazing, or tree felling. As part of the request for permission, residents are expected to provide a gift (monetary or otherwise) to pay for the application (Tshabuse, pers. comm., February 2012).

Inconsistencies between land-use policies stated by a chief and the reality on the ground are not uncommon in Venda. According to Tshisikhawe, Ethnobotany Lecturer at the University of Venda (pers. comm., February 2012), traditional leaders often don't travel through their territory to stay current with developments, but rather trust their closest subjects to inform them of anything of importance. At times, this results in partial knowledge of what is in fact occurring in the territory. In cases where subjects have gone against a chief's word, the chief would likely not want to admit this, as this would be admitting to the weakening traditional leadership system. Despite soil erosion being a primary concern, a trend noted during fieldwork is expansion of subsistence fields in unsuitable terrain, likely due to shortage of suitable areas. New fields are placed on steep slopes which are prone to erosion and sandy areas that are infertile for maize cultivation.

In Contrast, much of the information revealed by community members regarding their environment demonstrates the intimate understanding residents have of their surroundings and environmental change. This has come through experiencing elements in the landscape first hand. For example, connections have been drawn between the mistbelt forest and high water availability; bottoms of steep slopes and fertile soil; and pine trees and high water consumption (Tshidzivhe makhadzi & elders, pers. comm., January & February, 2012). The Chief has indicated that soil erosion is one of the main issues he deals with, and conducts soil erosion testing before granting permission for residents to cultivate on steep land (Netshidzivhe, pers. comm., February 2012). It is interesting to note that the Chief takes into account many types of information in land-use decision-making: other than physical conditions (such as soil erosion), land availability, ecological plant characteristics (such as a plant's consumption of water), spiritual consent (the ancestors' approval), and beauty. Simply put by the Chief: "when I see the place is beautiful, I have a right to say, 'I don't want people to touch this place'" (Netshidzivhe, pers. comm., February 2012). The Chief does not only deal with pragmatic issues such as land use, but also with the spiritual realm of asking permission for various activities from the ancestors and protection of the sacred sites. Traditional belief holds that if rules regarding the sacred sites are violated, it is the Chief who is seen as responsible due to his leadership role (Netshidzivhe, pers. comm., February 2012).

#### 4.3.5 Interaction between Traditional Leadership and Local Government

Traditional leadership and local government seem to function as two separate parallel governance systems, rarely overlapping. When seeking permission for a particular activity or land-use, the process is separate and different for traditional leaders and government – but both types of permission are required by the applicant. This results in two parallel systems, making the process very onerous. Another important dynamic in this context, is that there is a hierarchy of chiefs, whereby the economic and political ambitions of a more senior chief can be in conflict with the needs of individual communities and their chief (Pschorn-Strauss, pers. comm., July 2012). This also applies to land-use changes regulated by government, such as orchards (Khorombi, 2000), as subsistence farming is largely controlled by the headman. For example, a farmer applying for an orchard from a traditional leader would be required to seek permission from the local headman along with gifts accompanying the request. After initial approval, the headman will then seek the high Chief's permission, requiring additional gifts for the high Chief. The high Chief will then bring the request to the Department of Agriculture for approval. Due to the fact that the farmer has already had to "pay", and receive the approval of two tiers of

traditional leaders, the decision has essentially been rendered and communicated to the farmer. To the frustration of government officials, the Department of Agriculture thus acts as a “rubber stamping” authority rather than actually making a decision (Tshabuse, pers. comm., February 2012).

Every official interviewed stated that traditional leaders should be consulted regarding projects or other decisions in their area. Chief Netshidzivhe noted that he attends bi-annual meetings with Thulamela Municipality and Vhembe District Municipality government officials. For ad-hoc issues, the Chief deals with both municipalities depending on the matter, but for urgent matters, he usually approaches Vhembe District Municipality. An extension officer representing the Department of Agriculture is stationed in rural areas and is tasked with liaising between residents and government officials (Livhebe, pers. comm., February 2012). Similarly, social compacts are established by Komatiland Forests by forming working groups with plantation managers, traditional leaders and communities. This working group acts as a channel of communication whereby issues are discussed and resolved. Issues such as fire hazard mitigation, special interest site designation, and use of plantation land by villagers are addressed collaboratively. However, some community members still feel left out due to a poor understanding of the land management practices conducted by Komatiland and the observable effects in the landscape. For example, while foresters have confirmed that only targeted site-specific chemical herbicide spraying is conducted (Egan & Khosa, pers. comm. February 2012), residents are under the impression that spraying is conducted over large areas (Elder Aaron, pers. comm., February 2012). Due to many years of experience, plantation managers have affirmed that only a diplomatic and cooperative approach would work with local communities. Plantation managers are often familiar with the local culture as some originate from this same area, speak the same language, and have a working relationship with Chief Netshidzivhe (Egan & Khosa, pers. comm., February 2012).

#### **4.4 Summary**

In summary, the study area can be differentiated into two major landscape units. The northern unit is composed mainly of indigenous bushveld with surrounding settlements, whereas the southern unit is fragmented into pine plantation compartments and pockets of indigenous vegetation, particularly prevalent along watercourses. Soil erosion, plantation water consumption, and alien invasion have had effects on local streams and Lake Fundudzi, specifically in terms of water quantity. Historically, the plantation led to massive landscape change in the southern portion of the study area. This transformation has especially influenced

Thathe Forest, the most sacred site for the Netshidzivhe clan. Thathe has been disconnected from most surrounding indigenous vegetation and is currently surrounded by plantation lands. Nevertheless, its roles persist as a centre of worship, a key water source for rivers in the landscape, and an important ecological conservation pocket. As a reflection of the biophysical characteristics of the area, landscape governance is also split into two systems: traditional leadership controls land-use in the northern unit, while government controls the southern unit. In the northern area, interaction between the Chief and local government was found to be minimal, although local municipalities provide some infrastructure to Tshidzivhe village while the Chief manages land-use. Conversely, the southern area is managed by Komatiland, a parastatal affiliated with DAFF, who seem interested in proactively engaging with stakeholders to promote Komatiland's landscape management objectives.

University of Cape Town

# Chapter 5: Major Findings and Discussion

---

## **5.1 Introduction**

The most significant findings of this research relate to the divergence of the landscape in the tribal-governed northern portion and the commercial plantation southern portion of the study area. These will be referred to as the northern area and southern area for the purpose of this discussion. These differences are the result of the natural conditions of the landscape, coupled with the colonial and apartheid government's land-use restructuring. The climate and geology have transformed the topography, hydrology, and vegetation types of the area into favourable production conditions in the southern area of the landscape. These conditions brought about a complex political ecology whereby competing interests sought to control the production output, ultimately culminating in the forced removal of local people and conversion of the area to commercial pine plantation. Due to varying production potentials of different parts of the landscape, the southern area was converted to pine plantation under government control, while the northern area continued to be governed by traditional leadership and utilised for subsistence agriculture. Currently, a multitude of institutions including traditional leadership, government, and a parastatal company influence the landscape. Various anthropogenic activities have greatly shaped the area over the last century. Due to the mixture of commercial plantation and subsistence activities, the landscape has multifunctional roles. The different functions have given the landscape varying pattern characteristics, each having its own advantages and disadvantages for ecological function.

## **5.2 Multifunctional Landscape**

In order to address the first and second objectives of this study, the study area was analysed through the conceptual framework of multifunctional landscapes. This approach deals with the spatial relationship between land cover patches, further linking to land-uses and human dimensions. The notion of multifunctionality in landscapes relates to the ability of a landscape to provide a number of different services in addition to the production of nutrition and material commodities (Brandt & Vejre, 2004). Two types of multifunctionality are observed in the subject landscape. The first occurs when different activities take place in different parts of the landscape, such as subsistence livelihoods in the northern area and commercial forestry in the southern area. Another more complex type of multifunctionality takes place when a number of activities occur concurrently in the same area. For example, in the northern area, grazing,

harvesting, and cultivation activities largely overlap. In the southern area, commercial forestry and conservation overlap with tourism, grazing and harvesting, as well as cultural activities maintained in some of the plantation conservation areas. The overlap, mainly along the plantation boundary, of subsistence activities with commercial forestry results in further complexity due to differences in land-use goals of different stakeholders. The interaction of these land-uses yields certain efficiencies as well as conflicts, summarised in Table 2 (Haaland et al., 2011).

Two key conflicts are observed. A major conflict occurs in the confluence area between subsistence agriculture and commercial forestry, while another occurs due to the negative impact of agriculture and commercial forestry on conservation and environmental protection. At the core of conflicts between agriculture and commercial forestry are issues related to the unique environmental quality required for each of these uses. These can be understood as different ecosystem services rendered to each stakeholder for their own benefit. For example, unpolluted water and soil for agriculture, and areas protected from grazing cattle for commercial forestry. Compared to the above well-represented land-uses, conservation is not a major land-use in the study area and therefore does not have organised political representation in the same way that the Tshidzivhe community and Komatiland Forests represent their individual interests. Rather, different varieties of conservation interests are included in the discourse of the community, and still others are included as part of Komatiland's interests.

Activities triggering conflict between agriculture and forestry include harvesting of plants and cattle grazing by local communities on Komatiland-managed lands. These activities are tolerated by plantation managers; however, trampling of new saplings in newly established plantation compartments decreases commercial forestry productivity. According to plantation managers, harvesting and grazing of rare plants within the plantation conservation areas is undesirable as it degrades remaining indigenous vegetation pockets. This ultimately conflicts with Komatiland's Forest Stewardship Council (FSC) obligations of conservation (Egan & Khosa, pers. comm., February 2012), making grazing a delicate issue between communities and forestry managers.

Conversely, community members are concerned about the use of herbicides in controlling 'undesireable' plants, such as indigenous shrubs interfering with pine sapling growth or 'escapee' pines growing outside plantation compartments. The appearance of dead 'undesirable' trees or shrubs amidst otherwise live patches conjures worries as to the effects of



herbicides on grazing cattle, food harvests, and downstream water supply. Having intimate knowledge of the landscape, elders and makhadzis are particularly concerned about the cross-impacts that chemical sprays could have on the biotic and abiotic environment. However, without proper management, alien pine species escape the plantation compartments and encroach onto tribal land, cropping up in bushveld and forest edges, and converting grassland patches to pine forest. These pine 'escapees' have a detrimental effect on local ecology through increased water consumption, suppression of indigenous species, and conversion of habitat (Carrere & Lohmann, 1996; Armstrong et al., 1998). These plants have been observed particularly in grasslands where neither Komatiland nor the community seem to be proactive about their removal (see Figure 4.12)

The decline in water quantity is another concern observed in the broader ecological context of the area through the declining levels of Lake Fundudzi (Van der Waal, 1997) and desiccated springs and wetlands (Nemukula, 2005). However, conflicting views have been expressed by the community regarding the quantity of water flow. Some community members stated observed decrease in rain and desiccated springs (Elder Aaron, pers. comm., February 2012) and others conversely noted that some stream levels have remained the same (Tshidzivhe makhadzis, pers. comm., February 2012). Due to Tshidzivhe's location at high altitude, receiving relatively high rainfall in the Soutpansberg mountain range (Lahiff, 1997), water availability in the study area is not scarce compared to other low-lying areas in Limpopo where water stress is an accepted fact (Lahiff, 1997; Tapela, 2008). Still, the fact remains that commercial forestry is responsible for the uptake of a large proportion of water (Carrere & Lohmann, 1996; van der Waal, 1997; Nemukula, 2005), leading to the conclusion that in land-use conflicts the economic angle often triumphs over socio-ecological concerns (de Groot, 2006). This is likely a key reason for commercial forestry continuing its activities despite the mounting evidence of adverse effects to the local socio-ecological system (Carrere & Lohmann, 1996).

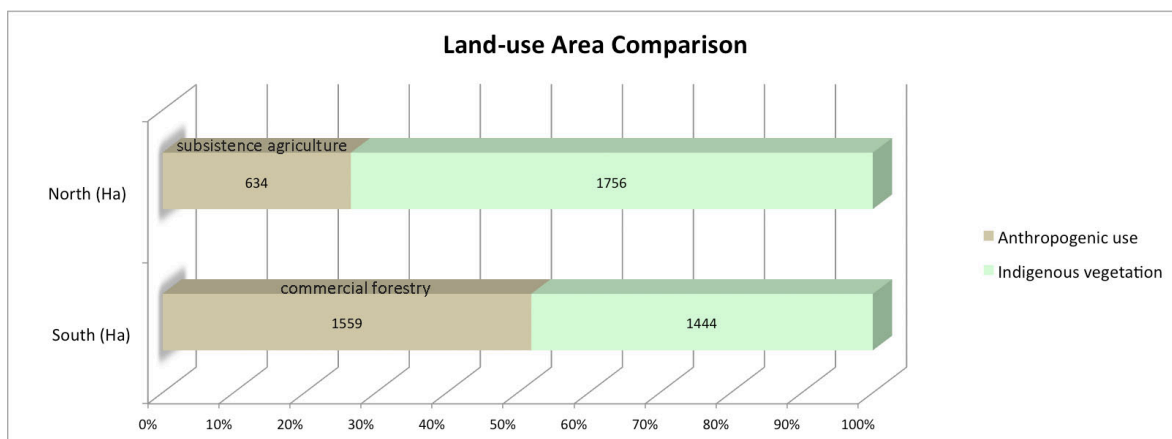
A number of anthropogenic activities are impacting water quality and quantity through land-use. Water is regarded as a sacred element in the Venda landscape (Khorombi, 2000; Tshiguvho, 2008), likely prompting the long-standing conservation of water features such as Lake Fundudzi as well as water-storing mistbelt forests (Mostert et al., 2008) such as Thathe Forest. Rivers, streams, and wetlands also function as connective elements joining various vegetation and land cover types across all environmental gradients, therefore physically tying the landscape together (see Figure 4.4). For example, the southwest portion of the study area flows into Lake Fundudzi, therefore influencing water quality and quantity in the Lake with water

filtered through plantation and indigenous forest. This area, which drains into the Mutale River, is the largest watershed contributor to Lake Fundudzi (van der Waal, 1997), therefore largely affecting the lake's cultural, subsistence, and ecological functions.

Due to the circuitous nature of watercourses in the study area (see Figure 4.4), degraded water originating from a singular location is likely to negatively affect a large area, including multiple environmental gradients, vegetation types, and human settlements. Water bodies such as Lake Fundudzi, being at the receiving-end of a degraded water catchment are declining in both quality and quantity (van der Waal, 1997; Khorombi, 2000). Van der Waal (1997) notes that "it appears that Lake Fundudzi does not enjoy special status amongst the local population any more" due to observed burning and harvesting of riparian wood. Similarly, Khorombi (2000) explains: "the culture of the Venda people is changing as traditional taboos are becoming acceptable. Traditionally Vendas did not eat fish from the lake, river, or from canned sources. Presently they are harvesting fish from the lake for consumption and for sale using line fishing and, to some extent nets." In turn, this is likely to result in further degradation of the Lake and its surrounds due to changes in its cultural importance. Given that indigenous vegetation patches in the study area have better water quality than plantation patches (Nemukula, 2005), protection of bushveld and mistbelt forest is valuable to the protection of water resources. Riparian buffers along watercourses also enhance ecosystem function and protect biodiversity (Fischer et al., 2006; Mander & Kimmel, 2008), carrying a compounded role in the very fragmented study area. Apart from policies and legislation being followed by Komatiland, the promotion of cultural practice including sacred sites and associated taboos are likely to be most effective in resource protection as these are ingrained in local culture (Bhagwat & Rutte, 2006).

Inception of forestry plantations in Venda was fuelled by South Africa's need for timber (Lahiff, 2000). These activities coincided with the implementation of forced land-use re-designation, known as 'betterment' (Lahiff, 2000), leading to forced removals of Tshidzivhe residents from their ancestral homesteads (see Ch. 2). Evictions, along with continuous manipulation of local residents have led to inevitable conflict between residents and the plantation (Tshidzivhe elders and makhadzis, pers. comm., January 2012). Currently, conflict resolution is undertaken by Komatiland. The parastatal acknowledges that conflict resolution works best through diplomacy and negotiation with the community (Egan, Khosa, & Nemakhavani, pers. comm., February 2012). As such, in the interest of cooperation, negotiations regarding grazing in particular are struck with the community to ensure they receive some benefits from the plantation. As these "benefits" are given to the community on their ancestral lands, many who previously inhabited

these lands are disheartened by the conversion of their landscape and its forced manipulation into a commercial production landscape. One elder remarked: "if the ancestors were to wake up now, they would not know where they are – they would not recognise this place" (pers. Comm., February 2012). Although Komatiland tries to appease communities by providing them with a range of benefits, it is clear that the only true compensation would be the return of their untransformed ancestral land.



**Figure 5.1: Land-use area comparison according to proportions of anthropogenic use and indigenous vegetation in the north and south portions of the study area**

Synergies between subsistence agriculture, conservation, and cultural activities also exist (Table 2). A key synergy is achieved through the retention of indigenous vegetation in the northern study area whereby tribal land is used for subsistence agriculture and associated traditional cultural activities on sacred sites. Due to continuous practices of traditional Venda culture and subsistence agriculture, most indigenous vegetation in these areas has been retained and landscape conversion to more intensive production systems was averted. Just under half of the study area is under tribal authority in the northern area. This area contains over half of the remaining indigenous vegetation in the study area as a whole, accounting for 73% (1,756ha, see Figure 5.1) of the land in the north area. This land was likely conserved in its natural state due to very steep slopes or rocky terrain, making the area largely unsuitable for subsistence activities. Similarly, community lobbying has resulted in the conservation of a number of mistbelt forest sites in the southern area, the most prominent of which is Thathe Forest. Cultural activities in sacred sites ensure that, at a minimum, forest and bushveld patches are reserved as a refuge and stepping-stones for wildlife (Bhagwat & Rutte, 2006).

Paradoxically, apart from the ecological damage caused by plantations (Carrere & Lohmann, 1996; Armstrong et al., 1998; Nemukula, 2005), commercial forestry management in the study

area contributes to biodiversity goals of the remaining indigenous vegetation through monitoring of conservation areas for biodiversity and ecosystem health, alien plant eradication, monitoring water quality, and allowing riparian and wetland areas to return to their natural state. In order to comply with FSC guidelines, forestry companies must avoid degradation of indigenous forest areas within their management boundaries (FSC, 1996; Komatiland Forests, 2008). However, it is noteworthy that these efforts are driven by controversial FSC certification guidelines. The FSC complex certification structure has been praised by some (Eden, 2009), but has also received a number of criticisms regarding its neoliberal influences. Specifically, concerns focus on FSC's inadequate considerations of natural vegetation conservation, as well as broader questions around appropriate production parameters and community involvement in conservation and poverty alleviation (Klooster, 2010; Boström, 2011).

Nevertheless, almost half of the southern area is covered in indigenous vegetation with no apparent plans of commercial forestry expansion by Komatiland (Egan, pers. comm., February 2012); this constitutes a large proportion considering the landscape is managed as a commercial plantation. The retention of indigenous vegetation within the commercial plantation boundaries has been explained by Komatiland Environmental Officer (Egan, pers. comm., February 2012) as areas that were not planted for practical historic reasons such as steep slopes (see Figure 5.2), difficult access, or rocky terrain. Contrastingly, the Tshidzivhe community noted that some remaining indigenous vegetation throughout the plantation such as river valleys and Thathe Forest have been retained due to historic community requests and negotiations with plantation managers at the time of commercial plantation establishment (Tshidzivhe makhadzi & Chief Netshidzivhe, pers. comm., February 2012). The truth is probably a combination of these two explanations; this area was likely spared due to its mistbelt forests and water sources which hold special value for the local people, as well as the impracticalities of transforming the area into a production landscape due to the rocky and steep terrain (Figure 5.2). Thathe Forest is also situated on steep and inaccessible terrain and is therefore not ideal for commercial forestry (Figure 5.2). It is possible, as occurred with other sacred sites, that plantation personnel were threatened by menacing events when attempting to enter these sites (Dept of Plural Relations and Venda Government Services, 1978). Such events are said to have protected Lake Fundudzi from development (Mabogo, pers. comm., January 2012) and the peak of another sacred site from conversion to plantation (Dept of Plural Relations and Venda Government Services, 1978). These protective forces are explained by local people as the actions of ancestral spirits.

		CONFLICTS			
		Subsistence agriculture	Commercial forestry	Conservation	Cultural activities
SYNERGIES	Subsistence agriculture		<ul style="list-style-type: none"> <li>• Use of chemical herbicides</li> <li>• Cattle grazing in plantation areas</li> </ul>	<ul style="list-style-type: none"> <li>• Soil erosion and sedimentation from agricultural practices</li> <li>• Unsustainable harvesting and grazing practices</li> </ul>	<ul style="list-style-type: none"> <li>• No observable conflicts</li> </ul>
	Commercial forestry	<ul style="list-style-type: none"> <li>• Expanded grazing, firewood collection and harvesting area</li> <li>• Some job creation supplementing local livelihoods</li> <li>• Ad-hoc community benefits provided through Komatiland corporate social responsibility programme</li> </ul>		<ul style="list-style-type: none"> <li>• Introduction of invasive <i>Pinus</i> species impacting water and soil</li> <li>• Use of chemical herbicides</li> <li>• Acidification of water and soil</li> <li>• Increased soil erosion due to forestry roads and tree felling</li> <li>• Isolation of small remnant indigenous vegetation pockets leading to landscape degradation and loss of biodiversity (Armstrong et al., 1998)</li> </ul>	<ul style="list-style-type: none"> <li>• Replacement of indigenous vegetation surrounding core of sacred site with pine plantation</li> <li>• Provision of road access to sacred sites encouraging unauthorised "visitors"</li> </ul>
	Conservation	<ul style="list-style-type: none"> <li>• "Default conservation" of most of the landscape due to non-arable land and difficult access</li> <li>• Establishment of tree nurseries to replenish mistbelt forest tree species</li> </ul>	<ul style="list-style-type: none"> <li>• Monitoring of conservation areas for biodiversity and ecosystem health, monitoring water quality, allowing riparian and wetland areas to return to natural state</li> </ul>		<ul style="list-style-type: none"> <li>• Management of plants in sacred sites as per traditional customs (Tshiguvho, 2008)</li> <li>• Plant harvest for cultural rituals</li> </ul>
	Cultural activities	<ul style="list-style-type: none"> <li>• Mutual reinforcement as part of the same traditional socio-ecological system</li> </ul>	<ul style="list-style-type: none"> <li>• Provide vehicular access to sacred site for worshippers</li> </ul>	<ul style="list-style-type: none"> <li>• Allows long term conservation of sacred site pockets</li> </ul>	

Table 2: Conflicts and synergies between tribal-ruled area and Komatiland-managed area



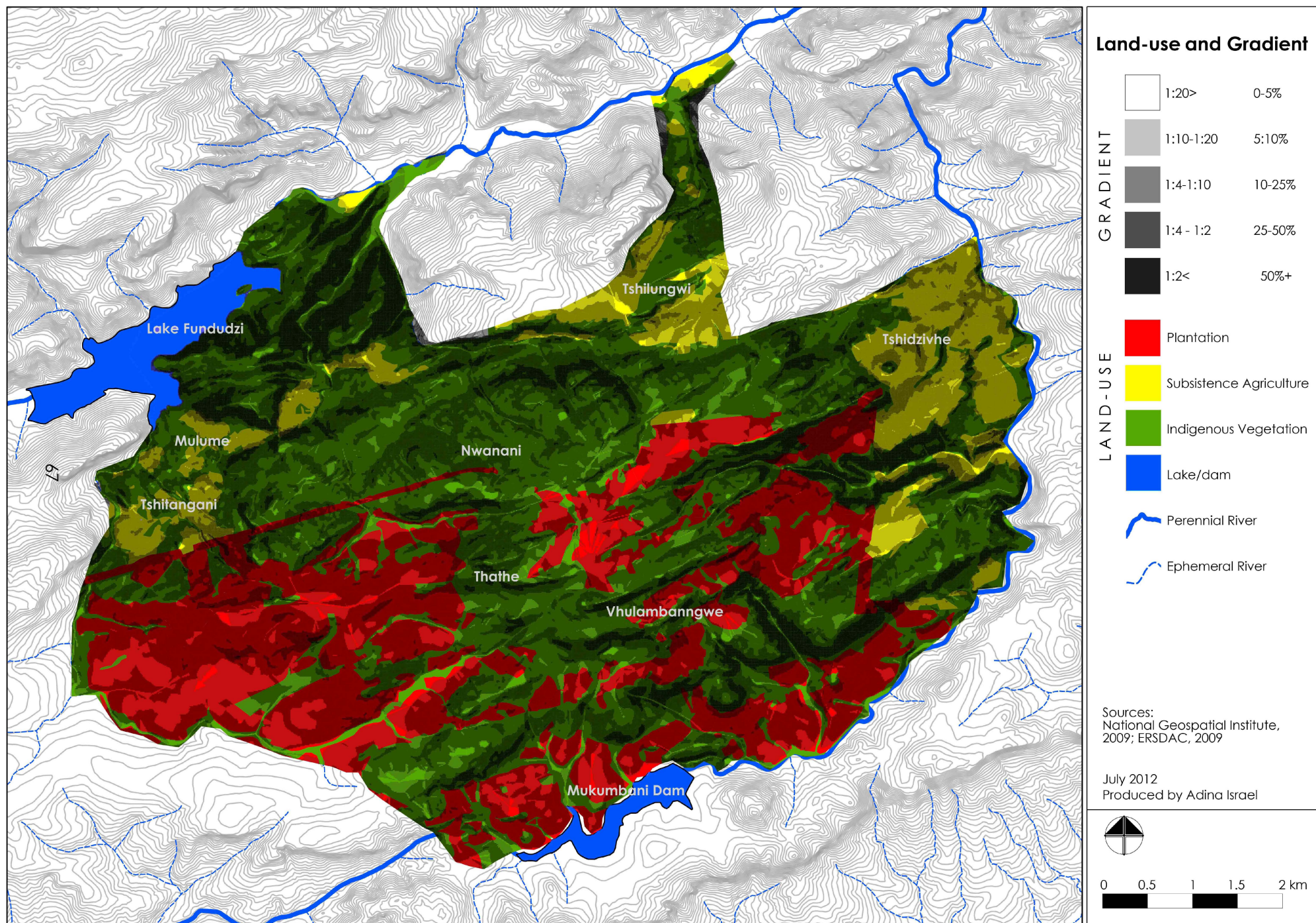


Figure 5.2: The distribution relationship between land-use and gradient in the study area.



However, Mabogo (pers. comm., January 2012) has explained these events being likely the acts of local people driven by cultural rules aiming to enforce traditional belief through proof of negative consequences to those ignoring traditional rules.

Other perceived benefits to the community are achieved through supplementing subsistence agriculture as well as ad-hoc support to local communities through provision of needed community facilities (Ntelemo, 2011). Additionally, provision and maintenance of road access to the west site of the study area also enables small-scale farmers to reach markets and facilitates access for residents to urban areas. Notably, benefits to local community are minimal compared to provincial and national benefits. The forestry industry was responsible for 3,300 direct jobs in Limpopo in 2009 (Forestry SA, 2010), whereas the national worth of forestry product sales in the same year was over 20 billion rand (DAFF, 2010).

### **5.3 Landscape Pattern**

The arrangement of elements in the landscape is referred to as the landscape pattern, often dictating the processes and functions in a given landscape (Forman & Godron, 1986; Marsh, 1998). To attain the first objective of this study, focusing on the spatial relationship between various land covers in the study area, the pattern of the subject area is evaluated using a number of guiding principles for production landscapes compiled by Fischer et al. (2006). Applicable principles are summarised in Table 3. Assessment of the landscape pattern against these principles reveals that the northern portion of the study area exhibits fragmentation at the individual-plant scale compared to the southern area, which exhibits fragmentation at the landscape-patch scale; these different types of fragmentation therefore affect different types of species (Lord & Norton, 1990).

The difference in fragmentation pattern between the tribal-ruled area in the north and the Komatiland-managed area in the south is a key observable difference. Indigenous bushveld constitutes the matrix in the northern portion with relatively large contiguous settlement areas containing small patches of indigenous vegetation. The diversity of plants within subsistence land-use types (settlements, fields and orchards, and disturbed land) is also much higher compared to plant diversity within plantation compartments. The commercial plantation is managed to provide ideal conditions only for cultivated *Pinus* species while eradicating other competing indigenous plants. In the south, pine

plantation forms the matrix. Two large indigenous vegetation corridors, linked through very narrow riparian corridors, divide this area. Due to species diversity being directly related to patch size, (McGuinness, 1984; Whittaker & Triantis, 2012), the tribal area in the north with its large contiguous bushveld matrix caters better to species diversity.

Another factor in species biodiversity are "Keystone structures" (see Ch. 2), being unique elements in the landscape that provide resources or shelter to a variety of species (Tews et al., 2004). In the study area, these elements are more likely to be found in heterogeneous complex habitats and non-abundant groundcover types due to the provision of unique structural elements of these areas (Tews et al., 2004). For example, mistbelt forest patches, grassland patches, river valleys, and rocky outcrops contribute to landscape heterogeneity and are likely to contain unique elements that may be scarce in homogeneous production landscapes such as plantation compartments. Due to the landscape pattern of the southern area, this landscape contains both extremes of

homogeneity and heterogeneity: very homogenous patches represented by plantation compartments and very heterogeneous patches represented by indigenous vegetation corridors. Moreover, the composition of these corridors is diverse as all three types of indigenous vegetation (forest, bushveld, and grasslands and rocklands) are represented (see Ch.4). The diversity in vegetation types contributes to landscape complexity, which in turn provides opportunity for varying keystone structures. This greater resources diversity caters to a wider assembly of species, therefore positively influencing biodiversity.

By relating the vegetation types in the area to the South African National Spatial Biodiversity Assessment (Rouget et al., 2005), it is evident that the conservation status of the remaining indigenous vegetation is vulnerable. Particularly, Soutpansberg Mountain Bushveld (Savanna biome) is only 2% protected, although 79% of this vegetation type remains. Of the Northern Mistbelt Forest (Forest biome) 84% remains and 11% is protected, however almost half (40%) of the Forest biome is critically endangered, therefore conservation of this biome should remain a priority. The Soutpansberg Summit Sourveld vegetation represents the Grassland biome; surprisingly 99% of this vegetation type remains intact, while 17% is protected, however, over half of the Grassland biome is threatened (Rouget et al., 2005), therefore conservation of this vegetation type would still benefit the overall Grassland biome.

<b>Landscape Pattern Element</b>	<b>Subsistence Agriculture (Northern Area)</b>	<b>Commercial Forestry (Southern Area)</b>
Large patches of native vegetation	<ul style="list-style-type: none"> <li>Indigenous bushveld forms the matrix.</li> <li>Village areas contain small patches of indigenous vegetation.</li> </ul>	<ul style="list-style-type: none"> <li>Pine plantation forms the matrix.</li> <li>Two large indigenous vegetation corridors exist with many smaller isolated native vegetation islands.</li> </ul>
Keystone structures (unique elements in the landscape providing resources or shelter to a variety of species)	<ul style="list-style-type: none"> <li>Large heterogeneous landscape outside villages and cultivation areas likely contain keystone structures, consisting mostly of indigenous bushveld.</li> </ul>	<ul style="list-style-type: none"> <li>Homogeneous pine plantation areas decrease the likelihood of keystone structures in the southern portion.</li> <li>Large established indigenous bushveld and mistbelt forest patches</li> <li>Thathe Forest likely contains keystone structures due to its complexity and long-standing conservation status.</li> </ul>
Matrix and patch contrast	<ul style="list-style-type: none"> <li>Most areas have low contrast due to gradual transition from fields to disturbed bush areas, and to indigenous bushveld.</li> </ul>	<ul style="list-style-type: none"> <li>High contrast between highly complex indigenous vegetation and homogeneous pine plantations.</li> </ul>
Corridors and stepping-stones	<ul style="list-style-type: none"> <li>Stepping-stones are very small in village, consisting of tree groves and bushy disturbed areas. However other than the village areas, there are few areas that are disconnected in this part of the landscape.</li> </ul>	<ul style="list-style-type: none"> <li>Large areas in the southeast are missing connective elements. The southwest is well connected through river valleys and indigenous vegetation corridors.</li> </ul>
Buffers around water courses	<ul style="list-style-type: none"> <li>No formal protection exists for water bodies, however these hold traditional importance (Tshiguvho, 2008).</li> <li>Encroachment is prevented due to location in steep wooded river valleys.</li> </ul>	<ul style="list-style-type: none"> <li>Grasslands and wetlands have been planted with pine and are desiccated.</li> <li>Riparian areas are being re-established through the DWAF-mandated wetland delineation policy.</li> </ul>
Environmental gradient preservation (representation of the spectrum of land types)	<ul style="list-style-type: none"> <li>Environmental gradient is well conserved.</li> </ul>	<ul style="list-style-type: none"> <li>Most grassland areas and some mistbelt forest patches have been converted to pine plantation.</li> </ul>
Geographic fragmentation vs. structural fragmentation	<ul style="list-style-type: none"> <li>Moderate geographic fragmentation and severe structural fragmentation around villages.</li> </ul>	<ul style="list-style-type: none"> <li>Severe geographic fragmentation and low structural fragmentation.</li> </ul>

**Table 3: Assessment of landscape pattern elements in subsistence agriculture and commercial forestry lands (adapted from Fischer et al., 2006)**

Given the high concentration of endemism in the Soutpansberg (Rouget et al., 2005; Mostert et al., 2008), these distinct land cover types play an important role in maintaining biodiversity in this region. The eradication of most of these areas has given the remaining indigenous vegetation patches a more prominent role in providing habitat and therefore protecting biodiversity. That the Forest is likely serving as a source of keystone structures to species in the area due to its complexity and long-standing conservation status, therefore more likely to contain complex elements. However, due to the surrounding pine plantation matrix, this landscape configuration lends itself to island effects due to high fragmentation (MacArthur & Wilson, 1967; Farina, 2006), therefore increasing the odds of species segregation, and possibly leading to a decline in biodiversity.

The creation of corridors and buffers along watercourses is an accepted practice to promote connectivity while simultaneously protecting sensitive riparian habitats (Fischer et al., 2006; Mander & Kimmel, 2008). The wetland delineation policy (DWAF, 2005) and its implementation in the study area (see Ch. 4) have therefore improved connectivity by creating buffer corridors along watercourses. In the northern area, few stepping-stones or corridors exist in areas visibly supporting subsistence agriculture, however they serve a minor role in this area compared to its southern counterpart given that the matrix here consists of contiguous indigenous bushveld. The few stepping-stones and corridors in the villages were not created but rather left aside due to practical reasons. For example, a remnant forest corridor in Tshidzivhe village is located on steep rocky ground. Due to inaccessibility this forest patch has been left standing.

Low contrast (similar vegetation structure) between the matrix and patches better caters to biodiversity maintenance, as these patches can be used for habitat provision and as connection corridors (Fischer et al., 2006). The subsistence landscape in the northern area is somewhat similar in character to the surrounding indigenous vegetation matrix, as changes in vegetation structure occur gradually (see Ch.4). This low contrast between indigenous vegetation and subsistence agriculture patches in the northern area is likely to provide habitat as well as connectivity corridors between indigenous vegetation pockets. The opposite is true for the plantation area, where a stark difference exists in terms of micro-climate, soil conditions, plant structure, water availability, and diversity between the plantation compartments and adjacent indigenous vegetation patches. The high contrast (dissimilar vegetation structure) in the southern area confines

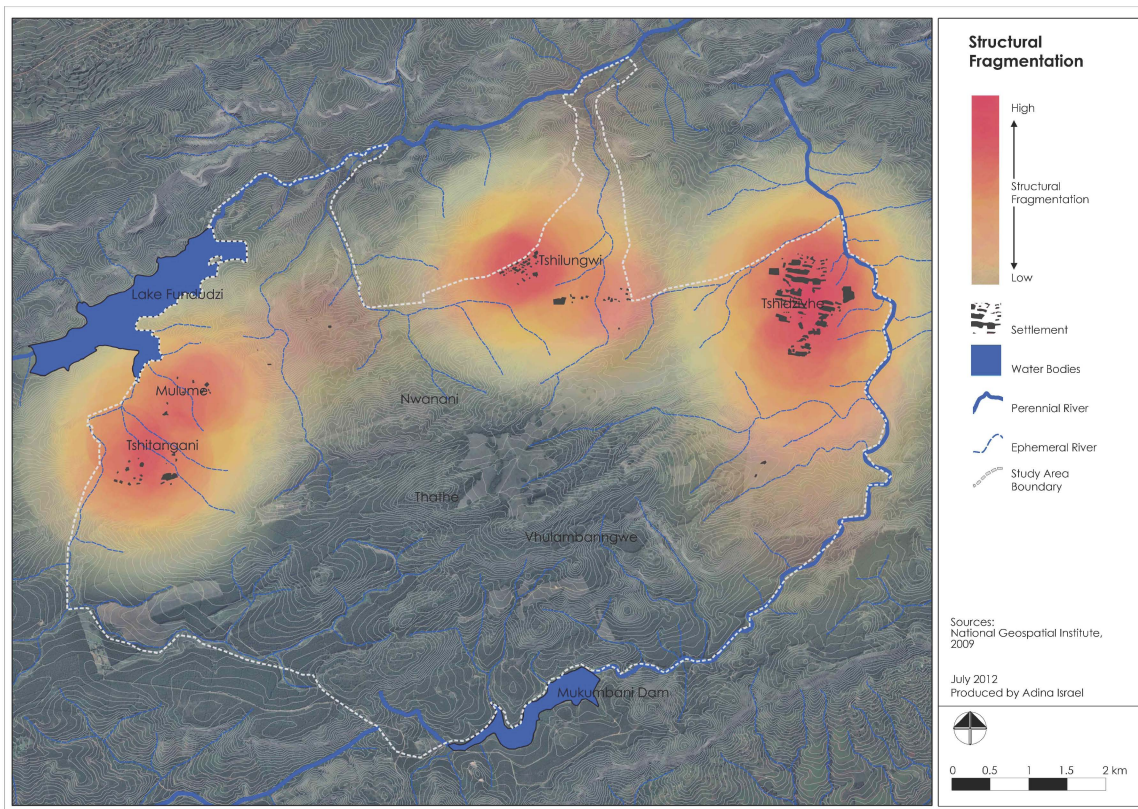
indigenous species to well-defined pockets and corridors, thereby diminishing the area available for hospitable habitat. This implies that the remaining indigenous forest, bushveld and riparian corridors carry an increased burden of protecting local biodiversity.

**Figure 5.3: Roads throughout the study area, showing the high geographical fragmentation throughout the plantation area.**

Structural fragmentation manifests itself at the individual-plant scale (Lord & Norton, 1990; Farina, 2006). For example, grazing cattle may remove some types of grasses or shrubs,



thus causing structural fragmentation. This type of fragmentation is most prevalent around settlements and dissipates in a concentric pattern as one moves toward the bushveld. Fields and orchards will therefore experience higher levels of structural fragmentation compared to disturbed land, and the latter will be more structurally fragmented than bushveld. Bushveld, serving as the matrix in this area, will likely experience structural fragmentation in the areas closest to the edges due to grazing, harvesting, and collecting of firewood. This type of fragmentation is not detectable using the mapping classification method, but was observed in the field.



**Figure 5.4: Structural fragmentation surrounding subsistence agriculture land-uses**

Given the above pattern of structural fragmentation around settlements, it is possible to provide a basic illustration based solely on distance from settlements and surrounding agricultural uses. Figure 5.4 illustrates which areas are most influenced by subsistence activities and hence most affected by structural fragmentation. This is depicted by concentric circles surrounding subsistence land-uses where coloured transparencies are overlaid, becoming increasingly opaque depending on the number of nearby “users” (households). A radius spanning 1,500m was used to display the spectrum of structural fragmentation as one moves away from settlement and subsistence agriculture patches, as per visual observation of subsistence agriculture impacts in the field. This approach is



based on central-place theory where land cover changes are observed in concentric circles around a human settlement (Forman, 2008). However, factors such as slopes, vegetation types, sacred sites, other disturbances, watercourses, barriers, and other factors must also be taken into account for a complete analysis.

Figure 5.4 is relatively consistent with observations made in the field. This type of analysis could assist in identifying lands suffering from structural fragmentation that are indiscernible through other means. Additionally, ecological corridors can be identified in areas with little structural fragmentation. For example, an important corridor of least anthropogenically-influenced land leads from Thathe, north to Nwanani, and continues north to the Mutale River, thus forming a north-south connection through the subject study area and beyond. In order for these corridors to be effective, conservation planners must ensure that corridors are adequately connected to other indigenous vegetation areas beyond the study area. Broader implications for conservation planning are presented through the opportunity of protecting existing ecological corridors from degradation. This would require much less effort than creating new ecological corridors on previously degraded land.

While taking into account geographical and structural fragmentation, as well as the three main land-uses (subsistence agriculture, commercial forestry, and conservation) a comprehensive landscape pattern emerges. This composite map, presented in Figure 5.5, shows the full extent of the remaining indigenous vegetation ecological corridor. A "bottle-neck" area between the north-south arm and the east-west arm composed of small plantation compartments impacts connectivity between the two sections of the corridor. Although small riparian corridors connect these sections, they are not substantial enough to act as biodiversity corridors. Other obstacles are presented by the firebreak in the east and the "cul-de-sac" to the ecological corridor in the southwest of the study area. These barriers hinder ecological connection with the larger landscape. Nonetheless, the existence of this indigenous vegetation corridor through the study area is an important backbone for ecological connectivity through the study area and the greater landscape.

The landscape pattern and fragmentation type thus vary widely between the tribally controlled area in the north and the commercial plantation in the south. These divergent types of landscape transformation exemplify different cultural reflections (Farina, 2006),

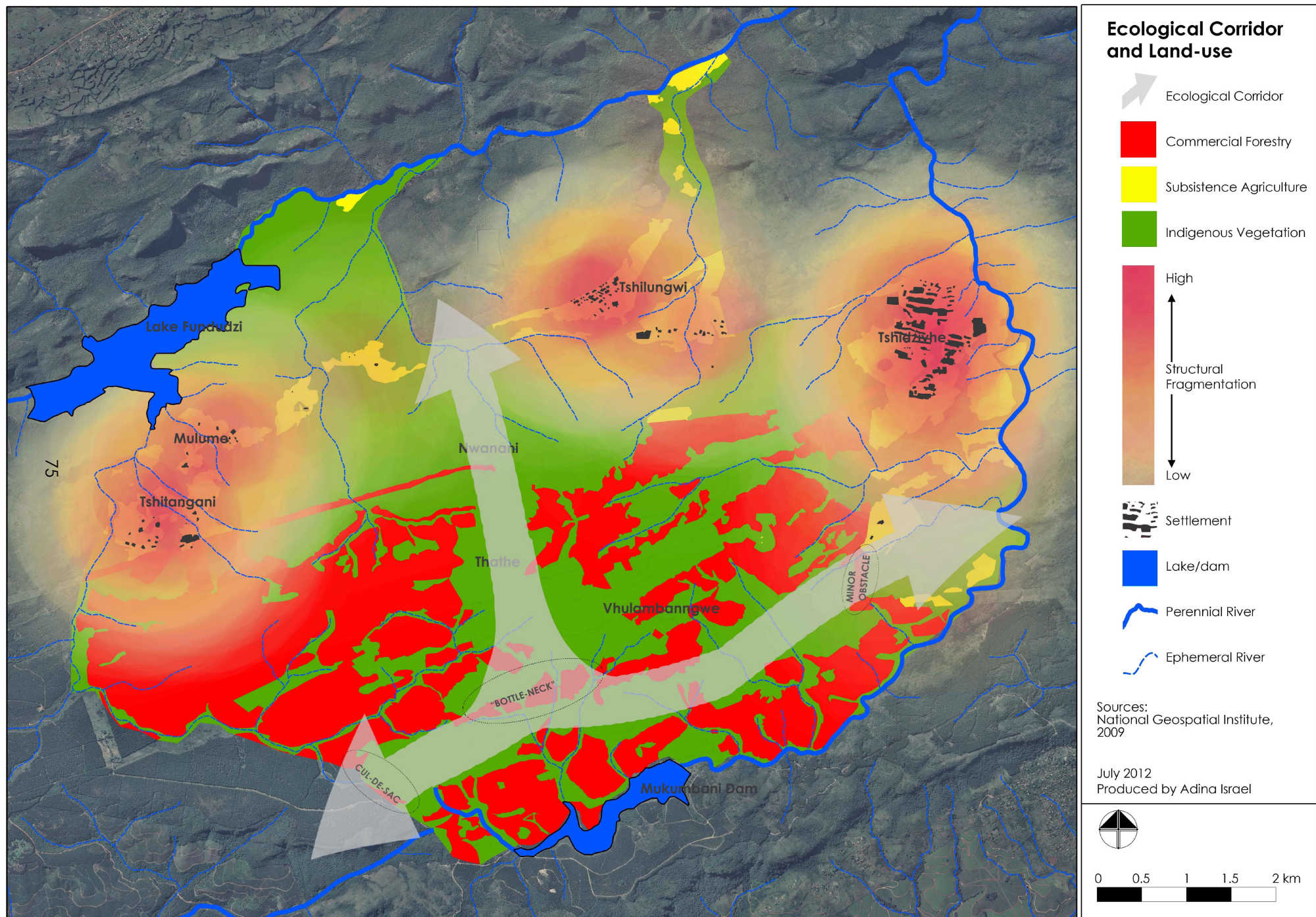


Figure 5.5: Composite map showing the three main land-uses (subsistence agriculture, commercial forestry, and indigenous vegetation) and the fragmentation types throughout the landscape.

as well as different resource production needs and abilities. Moreover, the commercial plantation component of the landscape is an example of excessive technological use, leading to rapid transformation of the landscape and environmental degradation (Naveh, 1995; Carrere & Lohmann, 1996; Nemukula, 2005). From a landscape structure perspective, the activities of the pine plantation remain confined to areas historically determined due to landscape suitability and inability to acquire further licenses. "Conservation" pockets within plantation boundaries are thus less likely to be impacted on a fine-scale by anthropogenic activities. However, due to the severe fragmentation of the plantation on a geographical scale, pockets of indigenous vegetation can support limited biodiversity due to their diminished size and connectivity (McGuinness, 1984; Farina, 2006; Fischer et al., 2006; Whittaker & Triantis, 2012). Contrastingly, subsistence agriculture visibly impacts a smaller and more compact proportion of land. These activities, however, tend to spill over into the adjacent native vegetation matrix causing fine-scale fragmentation. The remaining ecological corridor is unique in the landscape because of the general absence of geographical and structural fragmentation otherwise present in the remainder of the landscape. As this corridor crosses from the northern area to the southern area, it is currently being governed as separate entities by a multiplicity of stakeholders.

#### **5.4 Landscape Governance Conflict**

The landscape governance conflict in the study area was explored in order to address the third objective of the study which deals with landscape governance. Ecological heterogeneity in the Tshidzivhe landscape has created competition for natural resources culminating in landscape change. The ideal conditions of fertile soils, gentle topography, grassy plains, and ample precipitation meant that the southern portion of the landscape was arable, easily accessible, and naturally irrigated, therefore making it seemingly perfect for conversion to a production landscape. These biophysical factors, coupled with the imbalance in political and economic power between the governing white elite and the local black population, the land-use restructuring initiatives of the apartheid government, and South Africa's need for timber (Lahiff, 2000), have caused the southern area of the Tshidzivhe territory to become a contested landscape. Ultimately, local people were forcibly removed in the name of homeland agricultural development. This was followed by large tracts of land amassed for conversion to a production landscape (Lahiff, 2000). These events have set the stage for the current governance structure whereby the landscape is divided amongst different authorities (Table 4) and current

land governance policies are based on historic betterment policies (Lahiff, 2000). Similarly, the chieftaincy system implemented during apartheid has remained mostly intact (Lahiff, 2000; Oomen, 2005) especially regarding its control over land allocation. However, there are signs of shifting traditional beliefs and practices such as increased use of the Lake Fundudzi resources (Khorombi, 2000), cultivation on unsuitable lands (Ramudinqani, pers. comm., February 2012), and damaging indigenous plant harvesting practices contrary to traditional leaders' orders (Tshisikhawe, pers. comm., February 2012).

Tribal authorities still control land allocation and use of a large portion of the former homelands. These land-use decisions are not monitored by government authorities (Oomen, 2005). Land management in these areas is uncoordinated between traditional leaders and government and left largely to the personal judgement of traditional leaders (Oomen, 2005). Moreover, the various government bodies with jurisdiction over the area have yet to draw up a land-use plan for the study area (Maluleke, pers. comm., February 2012). However, government is tasked with provision of services to these areas (Thulamela Municipality, 2010; VDM, 2010), therefore despite their lack of involvement in land-use decisions in tribal areas, local government contributes to infrastructure planning and upgrade in these areas. In spite of the seeming lack of direction in strategic land-use planning, the Integrated Development Plans for Thulamela Municipality (2010) and Vhembe District Municipality (2010) list various services such as road improvement, and the provision of water and electricity, which can be witnessed to some extent on the ground. It is likely then, that these services are provided without taking into account future land-use change, bringing into question this investment by the municipalities.

Government officials at local, district, and provincial levels seem to be working in their own "silos" without having much knowledge about other policies directly relevant to their work. This was observed when inquiring about policies authored by another level of government, but directly related to a department's work (see Ch. 4). Another type of governance disconnect occurs due to the fact that different government entities are responsible for different parts of a unified landscape. Consequently, cross-impacts across the landscape are easily missed and holistic planning is made impossible. This governance disconnect was also noticed by Khorombi (2000) who has advocated for management of the Lake Fundudzi water catchment as a single unit.



	<b>Chief Netshidzivhe</b>	<b>Municipal, District, and Provincial Government</b>	<b>Komatiland Forests (DAFF)</b>
<b>Physical area of decision-making and major land-use</b>	<ul style="list-style-type: none"> <li>• North portion of Tshidzivhe Territory</li> <li>• Land-use: subsistence agriculture and indigenous vegetation</li> </ul>	<ul style="list-style-type: none"> <li>• North portion of Tshidzivhe Territory</li> <li>• Land-use: subsistence agriculture and indigenous vegetation</li> </ul>	<ul style="list-style-type: none"> <li>• South portion of Tshidzivhe Territory</li> <li>• Land-use: commercial plantations with indigenous vegetation corridors</li> </ul>
<b>Contribution to landscape management</b>	<ul style="list-style-type: none"> <li>• Land allocation, and land-use decisions, and resource management</li> </ul>	<ul style="list-style-type: none"> <li>• Provision of planning and policy documents such as Integrated Development Plans, rules and regulations, and forthcoming land-use plans</li> <li>• Provision of some physical infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Daily commercial plantation operation, road maintenance, alien eradication, and (forestry) conservation areas management</li> </ul>
<b>Impact on...</b>			
<b>Landscape pattern</b>	<ul style="list-style-type: none"> <li>• Regulates expansion of built, cultivated, and grazed land leading to increased geographical and structural fragmentation</li> </ul>	<ul style="list-style-type: none"> <li>• Little control over land-use allocation process</li> </ul>	<ul style="list-style-type: none"> <li>• Maintenance of a production landscape and associated geographical fragmentation</li> <li>• Establishment of watercourse buffers increasing connectivity between indigenous vegetation patches</li> </ul>
<b>Water</b>	<ul style="list-style-type: none"> <li>• Soil erosion resulting from subsistence agriculture</li> <li>• Domestic use</li> </ul>	<ul style="list-style-type: none"> <li>• Soil erosion prevention through awareness raising, soil stabilisation projects</li> <li>• Water reticulation</li> </ul>	<ul style="list-style-type: none"> <li>• High consumption by pine plantation – quantity consumption monitoring required</li> <li>• Water quality degradation due to commercial forestry activities and associated monitoring</li> <li>• On-going delineation of wetlands and re-establishment of indigenous vegetation</li> </ul>
<b>Sacred Sites</b>	<ul style="list-style-type: none"> <li>• Stewardship, protection, and continuity of tradition</li> <li>• Ecological conservation of ancient indigenous vegetation pockets</li> </ul>	<ul style="list-style-type: none"> <li>• Promotion and commercialisation as tourism sites in the name of economic development</li> </ul>	<ul style="list-style-type: none"> <li>• Continual identification of graves and designation as special interest site</li> <li>• Retention and classification of sites as special interest areas</li> <li>• No active management of sacred sites – informally, domain of community</li> </ul>

**Table 4: The decision-making authorities in the study area and their interaction with a variety of landscape elements.**



The out-sourcing of land-use and policy planning projects to consultants is a contributing factor in the lack of interaction between government departments and related policies. The local and district municipalities IDPs (Thulamela Municipality, 2010; VDM, 2010) were compiled in-house, however policy plans and land-use plans were created by consultants (Maluleke, pers. comm., January 2012; Malotsha, pers. comm., February 2012). By passing up the chance to write their own policy and land-use plans government departments are foregoing the opportunity for professional development of their staff and networking opportunities with stakeholders. This further hinders inter-departmental cooperation and relationship building, ultimately adding to the failure of holistic governance in the area.

Lack of communication between traditional leadership and government is another cause of the separate uncoordinated governing systems present in the Tshidzivhe landscape. An aspect that requires improvement at a practical and political level is the means of communication between traditional leaders and governmental bodies. Chiefs and government officials have their own separate decision-making arenas and it appears that communication is limited to a couple of times per year (see Ch. 4). The effectiveness of the provincial Agriculture Department's extension officers is questionable, as their existence and role did not surface in any interview with the community when questioned on communication with governing bodies. In comparison, communication between the Komatiland plantation and community members seems to be streamlined despite the fact that community members have hard feelings about the plantation. Likewise, in this communication paradigm, it appears that those who serve on the social compact are better informed regarding Komatiland's activities, as information does not always filter down to the entire community, therefore possibly creating misconceptions and misunderstandings. Improvement in communication between traditional leaders and governmental departments as well as between Komatiland's representatives and the community could foster a culture of information sharing and cooperation therefore leading to more holistic landscape management and governance.

Many government officials operate according to local cultural norms (Mabogo, pers. comm., January 2012), however cultural change is underway, driven largely by economic imperatives. For example, the push for tourism by Vhembe District Municipality (VDM, 2010; VDM, 2011) has caused a rift through local communities, with some chiefs

welcoming the opportunity for expanded development, and others strongly disapproving of this initiative about which they were not consulted. This also illustrates a gap in priorities to be bridged between government and traditional leadership, with government following a modern approach of wealth generation and traditional leaders heeding traditional spirituality (Mabogo, pers. comm., February 2012). In cases where sacred sites are being commercialised by government as tourism sites, the modern and traditional approaches are incompatible therefore representing a source of conflict. Table 4 summarises the different decision-making authorities in the study area and their interaction with a variety of landscape elements. Just as the landscape had conjured a complex political ecology in the past due to competition for its resources, new political ecologies, such as the conflict over commercialisation of sacred sites, continue to divide the social and ecological components of the landscape.

### **5.5 Reflection and Synthesis**

A number of frameworks are combined in this study to conduct a rapid assessment of the landscape pattern, its multiple functions, and related governing structures. The socio-ecological systems conceptual framework is used as a guide in linking the landscape and its parallel social structure. This approach recognises that social and ecological structures are closely linked and mirrored in one another (Naveh, 1995; Berkes et al., 1998). Evidence of this can be seen in the subject landscape in the way that the diverging governance structures have resulted in different types of land-use activities. The divergent cultural and socio-economic contexts for different parts of the landscape have also resulted in different impacts on the landscape; therefore each cultural system has made its own mark on the area in its control.

Further, a multifunctional landscape approach was used in order to combine the various functions of the landscape in a single analysis. The different functions were listed and analysed according to their compatibility (or incompatibility). This analysis was borrowed from a framework used by Haaland et al. (2011), where broad functions of the landscape are used in a farm re-design exercise. In the subject research, the analysis was conducted to better understand the dynamics between different landscape functions and corresponding stakeholders. This analysis can be further used in future evaluation of different landscape plans. The conceptual framework of Brandt & Vejre (2004) was useful in identifying different types of multifunctionality. However, in the subject landscape the spatial segregation is most apparent, although chronological segregation and

concurrent multifunctionality ("real multifunctionality") occurs as well. It is important to note, that although most functions are spatially segregated, cross-impacts occur due to the interconnectedness of the landscape, particularly through its watershed. Therefore, despite the apparent spatial disconnect implied by Brandt & Vejre (2004), divergent functions continue to affect each other.

In evaluating the landscape pattern, the framework provided by Fischer et al. (2006) has been quite useful in assessing and comparing various landscape features of the two identified landscape types. This framework seems to have been created with industrial landscapes in mind, where management is top-down and centralised. A particularly useful concept of "structural fragmentation" was borrowed from Lord & Norton (1990) in demonstrating the effect of human settlements and subsistence agriculture on existing indigenous vegetation.

The above frameworks are useful in analysing the landscape pattern (Objective 1) and its interaction with landscape users (Objective 2), however they do not offer a system by which to address the necessary landscape management. A brief exploration of the governance structure in place was conducted to situate the above findings in the context of landscape governance (Objective 3). The different systems of landscape governance were contextualised in their historical contexts as it applies to land issues and rural livelihoods (Lahiff, 2000; Ntsebeza, 2003; Oomen, 2005). An attempt was made through this analysis to identify specific impacts that stakeholders are making on particular landscape features. This approach uses the socio-ecological framework identified above as it connects governance (social) structures with the ecological impacts experienced in the landscape. The exploration of governance in the study area is significant in contextualising the potential for operationalisation of the landscape analysis conducted.

# Chapter 6:

## Conclusions and Recommendations

---

### **6.1 Review of Findings**

This study establishes the spatial landscape pattern and associated land-uses surrounding the Venda sacred site of Thathe Forest in Limpopo, South Africa, while investigating links to landscape governance. The research examined three aspects of the landscape in the study area:

1. The spatial relationship between the dominant land cover patches.
2. The links between physical terrain features, current land-uses, and human dimensions.
3. The decision-making processes related to land-use.

These aspects are further linked with landscape management and associated landscape ecology principles, providing future implications for landscape governance and conservation. These implications ultimately affect the protection of Thathe Forest and therefore its functional ability to provide ecosystem services to landscape users.

Related to all three objectives, a clear outcome resulting from this study is the differentiation between the north and south areas of the subject landscape. This relates to the divergent land-uses in the north and south (Objective 1), the conditions inherent in the landscape leading to these different land-uses (Objective 2), and the differing governance systems in place in these two portions of the landscape (Objective 3). As a whole, the landscape has multiple functions, the main ones being commercial forestry, subsistence agriculture, and conservation. A number of conflicts and synergies arise between these diverging uses. Key conflicts include the decline in water quantity and quality caused by the plantation, as well as damaging grazing and harvesting activities by residents in the plantation area. Both activities have negative effects on ecological conservation of the area. A major synergy noted includes conservation of large areas of indigenous vegetation, including the sacred site of Thathe Forest.

The landscape pattern tells a similar story, where severe large-scale fragmentation characterises the plantation area, contrasted with small-scale fragmentation in tribal-controlled lands. Each landscape portion provides benefits to ecological function with the greatest seemingly unplanned synergy attained in providing a relatively wide ecological corridor through the centre of the study area from Thathe Forest traversing the site to the north and south. Apart from terrestrial connections, water also unites the subject landscape through its meandering course throughout the landscape before draining into one of the main tributaries of Lake Fundudzi. Due to landscape conditions favouring production in the southern area, this portion of the landscape has been the subject of conflict between local people and government.

These circumstances have made the area a contested landscape, with this state of affairs continuing currently as two separate governing systems, traditional leadership and government, independently and together fraught with problems (Khorombi, 2000). Overall, the subject landscape is an extremely complex construction of the social structures governing and shaping it, as well as ecological complexity created through the unique environmental elements of the Soutpansberg Mountains coupled with anthropogenic effects.

## **6.2 Implications for Landscape Management and Recommendations**

This research provides a number of implications and related recommendations for landscape management in the study area. In order to ensure long-term viability of the remaining indigenous vegetation corridor which surrounds and supports Thathe Forest, it is suggested that a joint body could be tasked with its management, ideally composed of the various key stakeholders with appropriately shared responsibilities depending on the strengths and capacity of each stakeholder. This process hinges on capacity building of stakeholders and consensus building. This will also increase communication between governing entities in the landscape ensuring that diverging forestry and subsistence goals are achieved together with those promoting bio-cultural diversity and biodiversity conservation. The conservation benefits of this corridor are important for each stakeholder. The local community stands to gain increased protection for Thathe Forest, surrounding indigenous vegetation (used for food and medicinal plant harvesting) and related water resources. Komatiland would benefit through positive public relations and marketing, and by including this initiative in their FSC compliance portfolio. Government departments are likely to support this initiative as it is in line with the Vhembe IEMP and



could potentially support alternative revenue generating land-uses, such as eco-culturally sensitive tourism. A deeper investigation into existing socio-political drivers is required to decipher the current situation and provide organisational strategies for stakeholder engagement.

Coordinated landscape management is required to improve connectivity throughout and beyond the indigenous vegetation corridor, since well-connected landscapes are better hosts of biodiversity. Transformation of the “bottle-neck” area composed of relatively small plantation compartments (see Ch. 5) between the north-south and east-west arms of the corridor will greatly improve connectivity. Similarly, consideration for biodiversity connectivity in the way of stepping-stones across the firebreak on the eastern portion of the corridor is required. However, the establishment of an ecological corridor through the study area will not alone achieve the goals of landscape connectivity. Viable connections to the larger regional landscape must be identified, negotiated, and secured for long-term sustainability of indigenous species populations and ecosystem health in the study area. Although this is already being implemented to a certain extent, a widely practised strategy for connectivity includes large ecological buffers flanking rivers which double as connectivity corridors.

To ensure good water quality for the entire landscape, activities impacting water quality and quantity should be avoided where possible. In particular, areas located in the upper reaches of catchments, and impacting multiple catchments within the study area should be treated sensitively. This means that activities such as cultivation on steep land, clear cutting, and the use of chemical herbicides should be avoided as much as possible in upper reaches of the water catchment. As South Africa's only inland lake, Lake Fundudzi depends on the western water catchments of the study area. Land-uses in these catchments should practise caution so as to not contribute to degradation in the way of siltation, chemical pollution, and water scarcity of this special heritage and ecological resource.

Continued local stewardship is a key component in successful landscape management. Local residents not only improve or impact the landscape through their activities, but they serve as an informal watchdog. These “eyes on the landscape” can function as a decentralised monitoring body to balance and possibly stem unwanted developments. Continued stewardship is key for the thriving of Thathe Forest into the future. This sacred

site's continued existence is owed to the local people's traditional beliefs and dedication to its integrity throughout centuries. Thus it follows that traditional burials and cultural ceremonies must be encouraged to persist and be passed on to younger generations as a key part of a conservation strategy. From this perspective, the ecological conservation of Thathe Forest hinges on its importance to the local people and the continuation of traditional customs in this particular sacred site.

Land-use planning often uses absolute conceptual boundaries, thus the effects of resulting geographical fragmentation have been widely acknowledged by environmental planners. However, structural fragmentation, which is not readily observed in aerial photography, is often missed. This study highlights the importance of integrating this type of fragmentation into planning analysis, particularly for biodiversity planning where a great number of species are influenced by small-scale changes. As a starting point, the incorporation of concentric buffers around sources of structural fragmentation, such as villages, will result in a more complete biodiversity planning analysis. For a more accurate representation, barriers to structural fragmentation such as topography, water bodies, and man-made barriers should be incorporated.

In the interest of landscape conservation, synergies promoting land efficiencies should be sought out, explored, negotiated, and encouraged. Land-use conflicts and inequitable land distribution should be key goals for resolution, as it has been demonstrated that these factors are partly responsible for environmental degradation. While this approach may seem unrealistic, it is important to note that many of these activities are already taking place. Lastly, while planning for the future of the landscape, it is vital to take human needs and effects into consideration as a key landscape factor, as any efforts that omit these major elements are unlikely to succeed in an anthropogenic landscape.

### **6.3 Implications for Thathe Forest?**

The persistent existence of the Venda sacred site of Thathe Forest is owed to its strong cultural significance to the people of the Netshidzivhe clan. Through this socio-ecological relationship ecology informs culture, and culture in turn affects ecology. Thathe Forest is a focal portion of an important north-south indigenous vegetation corridor, connecting the area north of the Tshidzivhe Territory with the area southeast and southwest of the plantation area. Due to its high elevation in the landscape, Thathe is also the starting

point of most rivers in the landscape. For these reasons, Thathe Forest performs a number of important ecosystem services in terms of water provision and regulation, in addition to its important role as a cultural hub. It follows that ecological preservation of the forest contributes to long-term viability of water sources and ecological connectivity in the landscape. Through the undulating drainage courses of the landscape, many seemingly separate areas are in fact inter-connected by flowing water, and affected by its quality and quantity. For this reason, activities taking place in the upper reaches of water catchments have the most impact on the remainder of the landscape as these dictate the quantity and quality of water flow to lower reaches of the catchment. In light of Thathe Forest's focal point in the larger indigenous vegetation corridor, not only the forest itself hinges on continuity of cultural practices, but also the integrity of the corridor itself.

The location of Thathe Forest as a major connective element in the landscape gives it greater importance for a number of reasons. First, local people already see Thathe as the source of all rivers in their landscape, therefore the notion that Thathe Forest also acts as a major connective patch in the landscape reaffirms existing eco-cultural knowledge. Second, Thathe Forest forms part of the tiny forest biome which accounts for only 0.4% of all land in South Africa; almost half of this land is considered critically endangered (Rouget et al., 2005). This means that despite the relative small size of the forest, Thathe Forest's biodiversity conservation value is great in terms of its proportion of the overall Forest biome and its long-standing protection status amongst the local people. Third, indigenous vegetation surrounding Thathe Forest is able to buffer the sacred site from forestry and agrarian activities while enlarging its core area. Due to the multiplicity of inter-connections between culture, ecology, and governance, the key location of Thathe Forest in the landscape considerably strengthens the rationale for legal protection of this eco-cultural asset.

#### **6.4 Further studies and exploration**

Despite the fact that this geo-spatial study is centred on Thathe Forest, the information presented is not based on empirical data within Thathe Forest due to the cultural sensitivities of the sacred site. Empirical data and bio-monitoring relating to its biodiversity richness and ecosystem services provision may, however, bolster the case for its long term preservation. Specifically, the comparison of biodiversity within this focal Northern Mistbelt Forest sacred site and other sites would provide more accurate information regarding its biodiversity value. Additionally, quantification of activities contributing to

water quality and quantity degradation such as consumption by pine plantation compartments, chemical herbicide use, erosion, and irrigation would be beneficial for establishing a benchmark for mitigation through land-use regulation.

The study area is an anthropogenic landscape at the confluence of commercial forestry and subsistence agriculture land-uses. Thus, it is acknowledged that conservation in its purest form is not realistic, as turning this landscape into an area untouched by humans is not possible given the existing socio-ecological system in place. Ultimately, the links between the landscape terrain, land-uses, and human dimensions of this system have given rise to multifaceted political ecologies. This has resulted in a multifunctional landscape with a complex pattern rich in culture and biodiversity. As the area is home to many species, including humans, it is valued for ecological, social, and economic reasons and therefore requires sensitive use and management into the future through stakeholder compromise and cooperation.

# References

---

- Anderson, D.M., Salick, J., Moseley, R.K. & Xiaokun, O., 2005. Conserving the sacred medicine mountains: A vegetation analysis of Tibetan sacred sites in northwest Yunnan, *Biodiversity and Conservation*, 14(13), pp. 3065-3091.
- Anon, 2011. Celebrating women activists : South Africa's Mphatheleni Makaulule. *Ecologist*. Available at: [http://www.theecologist.org/how\\_to\\_make\\_a\\_difference/cleaner\\_air\\_water\\_land/802733/celebrating\\_women\\_activists\\_south\\_africas\\_mphatheleni\\_makaulule.html](http://www.theecologist.org/how_to_make_a_difference/cleaner_air_water_land/802733/celebrating_women_activists_south_africas_mphatheleni_makaulule.html) [Accessed September 7, 2011].
- Antrop, M., 2000. Background concepts for integrated landscape analysis. *Ecosystems*, 77(July 1999), pp.17-28.
- Armstrong, A.J., Benn, G., Bowland, A.E., Goodman, P.S., et al., 1998. Plantation forestry in South Africa and its Impact on biodiversity, *Southern African Forestry Journal*, 182(July), pp. 37-41.
- Ataroff, M. & Rada, F., 2000. Deforestation impact on water dynamics in a Venezuelan Andean cloud forest, *Ambio*, 29(7), pp. 440-444.
- van Averbek, W. & Bennett, J., 2007. Agro-ecology, land-use and smallholder farming in the Central Eastern Cape, In Hebinck, P. and Lent, P.C. (eds.), *Livelihoods and Landscapes: The People of Guquka and Koloni and their Resources*, Leiden & Boston: Brill.
- Bastian, O., 2000. Landscape classification in Saxony (Germany) - a tool for holistic regional planning. *Landscape and Urban Planning*, 50, pp.145-155.
- Bastian, O., 2004. Functions, leitbilder, and red lists - expression of an integrative landscape concept. In J. Brandt & H. Vejre (eds.), *Multifunctional landscapes: Theory, values and history*. Bostong: WIT Press, p. 306.
- Berkes, F., Folke, C. & Colding, J., 1998. *Linking social and ecological systems: management practices and social mechanisms for building resilience*, Cambridge: Cambridge University Press.
- Bhagwat, S.A. & Rutte, C., 2006. Sacred groves : potential for biodiversity management. *Frontiers in Ecology and the Environment*, 4(10), pp.519-524.
- Blain, J. & Wallis, R.J., 2004. 'Sacred sites , contested rites / rights : contemporary pagan engagements with the past'. *Journal of Material Culture*, 9(3), pp.236-261.
- Boström, M., 2011. The problematic social dimension of sustainable development: The case of the Forest Stewardship Council. *International Journal of Sustainable Development & World Ecology*, 19(1), pp.3-15.
- Brandl, G. 2002. *The geology of the Alldays area: Explanation: Sheet 2228, 1:250 000*, Pretoria: Council for Geoscience.



- Brandt, J. & Vejre, H., 2004. Multifunctional landscapes - motives, concepts, & perspectives. In J. Brandt & H. Vejre (eds.), *Multifunctional Landscapes*. Boston: WIT Press.
- Büscher, B. & de Beer, E., 2010. The contemporary paradox of long-term planning for social-ecological change and its effects on the discourse- practice divide: evidence from Southern Africa, *Journal of Environmental Planning and Management*, 54(3), pp. 37-41.
- Carrere, R. & Lohmann, L., 1996. *Pulping the South: Industrial Tree Plantations and the World Paper Economy*, London & New Jersey: Zed Books.
- Climate System Analysis Group (CSAG), 2012. Climate Information Portal: Mukumbani Tea Estate, temperature and rainfall data 1986-2010, Cape Town: University of Cape Town. Available at: <http://cip.csag.uct.ac.za/webclient/map> [Accessed April 15, 2012].
- Costanza, R., d'Arge, R., de Groot, R., Farber, S., et al., 1997. The value of the world's ecosystem services and natural capital, *Nature*, 387(6630), pp. 253-260.
- Croissant, C., 2004. Landscape patterns and parcel boundaries: An analysis of composition and configuration of land use and land cover in south-central Indiana. *Agriculture, Ecosystems & Environment*, 101(2-3), pp.219-232.
- Department of Agriculture Forestry and Fisheries (DAFF), 2010. *Report on commercial timber resources and primary roundwood processing in South Africa*, Forestry Economics Services, Pretoria: DAFF.
- Department of Plural Relations and Venda Government Services, 1978. *Legends and tales within and near the Vondo-Thathe and Tshamanyatshe forests*. Compiled by W.M.D. Dhopi. Komatiland Forests (unpublished).
- Department of Water Affairs and Forestry (DWAF), 2004. *Internal strategic perspective: Luvuvhu/Letaba water management area*, Pretoria: DWAF.
- Department of Water Affairs and Forestry (DWAF), 2005. *A practical field procedure for identification and delineation of wetlands and riparian areas*, Pretoria: DWAF.
- Eden, S., 2009. The work of environmental governance networks : Traceability, credibility and certification by the Forest Stewardship Council. *Geoforum*, 40(3), pp.383-394.
- Farina, A., 1998. *Principles and methods in landscape ecology*, Dordrecht: Springer.
- Farina, A., 2000. The cultural landscape as a model for the integration of ecology and economics, *Bioscience*, 50(4), p. 313.
- Farina, A., 2006. *Principles and methods in landscape ecology: Toward a science of landscape*, Dordrecht: Springer.
- Fischer, J., Lindenmayer, D.B. & Manning, A.D., 2006. Biodiversity, ecosystem function, and resilience : Ten guiding principles for commodity production landscapes. *Frontiers in Ecology and the Environment*, 4(2), pp.80-86.
- Food and Agriculture Organisation (FAO) & International Soil Reference and Information Centre (ISRIC), 2003. *Soil and terrain database for Southern Africa*, Rome: FAO. Available at: <http://www.isric.org/projects/soter-and-wise-based-soil-property-estimates-southern-africa> [Accessed March 15, 2012].

- Forestry South Africa, 2010. *The South African forestry and forest products industry 2009*, Available from: <http://www.forestry.co.za/statistical-data/> [Accessed 15 May 2012].
- Forestry Stewardship Council, 1996. *FSC international standard: FSC principles and criteria for forest*, Bonn: FSC. Available from: [http://www.fsc.org/fileadmin/web-data/public/document\\_center/international\\_FSC\\_policies/standards/FSC\\_STD\\_01\\_001\\_V4\\_0\\_EN\\_FSC\\_Principles\\_and\\_Criteria.pdf](http://www.fsc.org/fileadmin/web-data/public/document_center/international_FSC_policies/standards/FSC_STD_01_001_V4_0_EN_FSC_Principles_and_Criteria.pdf) [Accessed 15 April, 2012].
- Forman, R.T.T., 2008. *Urban regions: Ecology and planning beyond the city*, Cambridge: Cambridge University Press.
- Forman, R.T.T. & Godron, M., 1986. *Landscape ecology*, New York: Wiley.
- Goodwin, H., 1996. In pursuit of ecotourism. *Biodiversity and Conservation*, 5(3), pp.277-291.
- Grobler, J.H.F., 2005. *Community perceptions of tourism in the Tshivhase area, Limpopo Province*, MA. University of Pretoria.
- de Groot, R., 2006. Function-analysis and valuation as a tool to assess land use conflicts in planning for sustainable, multi-functional landscapes. *Landscape and Urban Planning*, 75(2006), pp.175-186.
- Haaland, C., Fry, G. & Peterson, A., 2011. Designing farmland for multifunctionality. *Landscape Research*, 36(1), pp.41-62.
- Holling, C., 1973. Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics*, 4, pp.1-23.
- Johnson, L.M. & Hunn, E.S., 2010. Introduction. In Johnson, L.M. & Hunn, E.S. (eds.), *Landscape ethnoecology: concepts of biotic and physical space*, New York, Berghahn Books. p.319.
- Kabanda, T.A., Climate, University of Venda, Limpopo Biosphere Initiative. Available at: [http://www.soutpansberg.com/workshop/pdf\\_files/climate.pdf](http://www.soutpansberg.com/workshop/pdf_files/climate.pdf). [Accessed April 15, 2012].
- Khorombi, M., 2000. *Towards a sustainable land-use plan for the Lake Fundudzi catchment area*. M Inst. Agrar. University of Pretoria.
- Klooster, D., 2010. Geoforum standardizing sustainable development? The Forest Stewardship Council's plantation policy review process as neoliberal environmental governance. *Geoforum*, 41(1), pp.117-129.
- Komatiland Forests, 2008. Environmental management. Available at: [www.safcol.co.za](http://www.safcol.co.za) [Accessed April 15, 2012].
- Lahiff, E., 1997. Land, Water and local governance in South Africa: A case study of the Mutale river valley. *Rural Resources Rural Livelihoods Working Paper Series*, Institute for Development Policy and Management, University of Manchester.
- Lahiff, E., 2000. *An apartheid oasis? Agriculture and rural livelihoods in Venda*, London: Frank Cass.

- Leach, M., Mearns, R. & Scoones, I., 1999. Environmental entitlements: Dynamics and institutions in community-based natural resource management, *World Development*, 27(2), pp. 225-247.
- Lebel, L., Anderies, J.M., Campbell, B., Folke, C., et al., 2006. Governance and the capacity to manage resilience in regional social-ecological systems, *Ecology and Society*, 11(1).
- Lord, J.M. & Norton, D.A., 1990. Scale and the spatial concept of fragmentation. *Conservation Biology*, 4(2), pp.197-202.
- Mabogo, D.E.N., 1990. *The ethnobotany of the Vhavenda*, MSc. University of Pretoria.
- MacArthur, R.H. & Wilson, E.O., 1967. *The theory of island biogeography*, Princeton, NJ: Princeton University Press.
- Mander, Ü. & Kimmel, K., 2008. Wetlands and riparian buffer zones in landscape functioning. In S. Hong et al., eds. *Landscape ecological applications in man-influenced areas: Linking man and nature systems*. Dordrecht: Springer, pp. 329-357.
- Mark, D.M., Turk, A.G. & Stea, D., 2010. Ethnophysiography of arid lands: Categories for landscape features, In Johnson, L. M. and Hunn, E. S. (eds.), *Landscape ethnoecology: Concepts of biotic and physical space*, New York, Berghahn Books, p. 319.
- Marsh, W.M., 1998. *Landscape planning: Environmental applications*, New York: Wiley.
- McGuinness, K.A., 1984. Species–area curves. *Biological Reviews*, 59(3), pp.423–440.
- McHarg, I.L., 1971. *Design with nature*, Garden City, NY: Doubleday/Natural History Press.
- Mostert, T.C., Bredenkamp, G.J., Kloppe, H.L., Verwey, C. & Mostert, R.E., 2008. Major vegetation types of the Soutpansberg Conservancy and the Blouberg Nature Reserve, South Africa, *Koedoe*, 50(1), pp. 32 - 48.
- Mucina, L. & Rutherford, M.C., 2006. *The vegetation of South Africa, Lesotho and Swaziland*, South African National Biodiversity Institute.
- Mupo Foundation, 2010. *The Mupo Foundation: Report on activities 2009-2010*, Thohoyandou, Limpopo.
- Naveh, Z., 1995. Interactions of landscapes and cultures. *Landscape and Urban Planning*, 32(94), pp.43-54.
- Ndubisi, F., 2002. *Ecological planning: A historical and comparative synthesis*, Baltimore: MD: John Hopkins University Press.
- Nemukula, K.N., 2005. *An investigation into the impacts of forestry activities on wetland ecosystems at Thathe Vondo plantation in the Limpopo province*, MSc. University of Venda.
- Ntelemo, B., 2011. 3 schools get 20 computers, *Sowetan*, Johannesburg, 11th July. Available at: <http://www.sowetanlive.co.za/news/2011/07/22/3-schools-get-20-computers> [Accessed May 11, 2012]

- Ntsebeza, L., 2003. Land rights and democratisation : Rural tenure reform in South Africa's former bantustans. *Transformation*, 52, pp.68-95.
- Oberholzer, B., 2011. *Reading the landscape: Notebook*, Landscape Notebook Series. Cape Town: B. Oberholzer.
- Oomen, B., 2005. *Chiefs in South Africa: Law, power & culture in the post-apartheid era*, New York: Palgrave.
- Ormsby, A.A. & Bhagwat, S.A., 2010. Sacred forests of India : A strong tradition of community-based natural resource management. *Environmental Conservation*, 37(3), pp.320-326.
- Ramakrishnan, P.S., 2003. Linking natural resource management with sustainable development of traditional mountain societies. *Tropical Ecology*, 44(1), pp.43-54.
- Rescia, A., Pons, A., Lomba, I., Esteban, C. & Dover, J. (2008) Reformulating the social-ecological system in a cultural rural mountain landscape in the Picos de Europa region (northern Spain), *Landscape and Urban Planning*, 88(1), pp. 23-33.
- Reyers, B., O'Farrell, P.J., Nel, J.L. and Wilson, K., 2012. Expanding the conservation toolbox: conservation planning of multifunctional landscapes, *Landscape Ecology*, 27(8), pp. 1121-1134.
- Rouget, M., Reyers, B., Jonas, Z., Desmet, P., Driver, A., Maze, K., Egoh, B. & Cowling, R.M. 2004. *South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 1: Terrestrial Component*. Pretoria: South African National Biodiversity Institute.
- Silima, V., 2007. *A review of stakeholder interests and participation in the sustainable use of communal wetlands : The case of the Lake Fundudzi catchment in Limpopo Province, South Africa*, M.Ed. Rhodes University.
- South African Heritage Resources Agency (SAHRA), 2011. The legislation. Available at: <http://www.sahra.org.za/legislation.htm> [Accessed November 16, 2011].
- South African Soil Classification Working Group, 1991. *Soil classification - a taxonomic system for South Africa*. Pretoria: Agricultural Research Council-Institute for Soil, Climate and Water.
- Starkloff, F., 1998. Water scarcity in Kitulwatte: The social causes and consequences of environmental degradation in a highland Uva village of Sri Lanka, *World Development*, 26(6), pp. 913-932.
- Tapela, B.N., 2008. Livelihoods in the wake of agricultural commercialisation in South Africa's poverty nodes: Insights from small-scale irrigation schemes in Limpopo Province. *Development Southern Africa*, 25(2), pp.37-41.
- Tews, J., Brose, U., Grimm, V., Tielborger, K., et al., 2004. Animal species diversity driven by habitat heterogeneity/diversity: The importance of keystone structures, *Journal of Biogeography*, (31), pp. 79-92.
- Thulamela Municipality, 2008. *Welcome to Thulamela Local Municipality: Places of Interest*. Available at: [http://www.thulamela.gov.za/tourism/places\\_of\\_interest/place\\_of\\_interest.asp](http://www.thulamela.gov.za/tourism/places_of_interest/place_of_interest.asp) [Accessed September 5, 2011].

- Thulamela Municipality, 2010. *Review of Thulamela Municipality integrated development plan 2010-11*. Available at:  
<http://mfma.treasury.gov.za/Documents/03.%20Service%20Delivery%20and%20Budget%20Implementation%20Plans/2010-11/02.%20Local%20Municipalities/LIM343%20Thulamela/01.LIM343%20IDP%20DRAFT%20DOCUMENT%202010%202011.pdf> [Accessed April 10, 2012].
- Tiwari, B.K., Barik, S.K., & Tripathi, R.S., 1998. Biodiversity value, status, and strategies for conservation of sacred groves of Meghalaya, India', *Ecosystem Health*, 4(1), pp. 20-32.
- Tshiguvho, T., 2008. *Sacred traditions and biodiversity conservation in the forest montane region of Venda, South Africa*, Ph.D. Clark University.
- Tzanopoulos, J. & Vogiatzakis, I.N., 2011. Processes and patterns of landscape change on a small Aegean island: The case of Sifnos, Greece. *Landscape and Urban Planning*, 99(1), pp.58-64.
- Vhembe District Municipality, 2009. *Integrated environmental management plan*, Mokwale Consulting, Thohoyandou, Limpopo.
- Vhembe District Municipality, 2010. *2010/11 Integrated Development Plan (IDP) Review*. Development Planning Department, VDM, Thohoyandou, Limpopo.
- Vhembe District Municipality, 2011. *Vhembe District Municipality: Tourism*. Available at:  
<http://www.vhembe.gov.za/index.php?page=tourism> [Accessed September 5, 2011].
- van der Waal, B., 1997. Fundudzi, a unique, sacred and unknown South African lake. *Southern African Journal of Aquatic Science*, 23(1), pp.42-55.
- Walker, B., Holling, C.S., Carpenter, S.R. & Kinzig, A., 2004. Resilience, adaptability and transformability in social-ecological systems, *Ecology And Society*, 9(2).
- Whittaker, R.J. & Triantis, K.A., 2012. The species-area relationship: An exploration of that 'most general, yet protean pattern', *Journal of Biogeography*, 39(4), pp. 623-626.



# Appendices

---

## **Appendix A: Research Protocol Agreement**

### **Ethics Protocol for Research Work in the Venda Region by Students of the University of Cape Town, Environmental Geographical Science Department**

This document outlines the ethical guidelines and practices for research activities of the projects entitled “Mapping spatial-temporal changes of the availability of forest resources using remote sensing and participatory mapping for the Thathe-Vondo Forest, Thohoyandou” and “The Role of Sacred Sites in the Venda Socio-Ecological Landscape”, to be conducted by University of Cape Town (UCT) postgraduate Masters students, Samantha Lee Pan and Adina Israel, respectively. This protocol is required to ensure that research is carried out with a defined code of conduct, clarifying expectations from the researchers (from UCT), the Mupo Foundation (or Mupo, the NGO working with the community), and the local community (people of the villages where research is conducted).

The following are the principles to be adhered to prior to, throughout, and following the research activities:

#### GENERAL GUIDING RESEARCH PRINCIPLES

1. Active participation of the community will be represented through Mupo by way of approval and discussion of research methods, an ethics protocol, technical matters, logistics and other considerations from the researchers. The Mupo Foundation is also one of the beneficiaries of the research as the information gathered and results will be shared with them to inform their current work.
2. The researchers will respect and remain conscious of the culture, traditions and beliefs of the local people and will avoid doing anything that may cause disruption to these, with special consideration of the sensitivities around sacred sites. The biocultural significance of the area is of highest importance to the researchers and concurs to the vision and aims of the community and Mupo.
3. Wherever possible, the research activities will be conducted in the local language, Tshivenda. Once agreed to by the Mupo Foundation and community leaders, this protocol will be translated to Tshivenda and provided to them as a record of the ethics protocol.

#### PRINCIPLES FOR FIELD WORK, COMMUNITY PARTICIPATION AND COLLECTION OF INFORMATION

4. Prior to any research activities taking place, consent will be sought from the community in a manner that is culturally appropriate and understandable to them to enable meaningful consent. Consent to work in specific areas will be sought from the appropriate community leaders (makhadzis, chief, and/or headman).
5. Prior to the research activities individual participants will be provided with a brief introduction of the project and this research protocol, in the local language. The methods of gathering information, namely, note taking,

photographs, video, participatory mapping, Geographical Positioning System (GPS) and any other method used will be explained to participants.

6. Prior informed consent will be sought from individual participants in the local language before their involvement in any research activity. Participants have the right to say “no” or leave at any point during a research activity if they feel it goes against their cultural, individual, or communal interests. This will be explained before any research activity begins.
7. Culturally sensitive areas and sacred sites will be respected and research activities avoided in these areas. The researchers will rely on community representatives to inform them which locations must be avoided.
8. Wherever possible, local persons from the community will be employed to assist with research fieldwork, coordination and facilitation, therefore contributing to local livelihoods. Capacity and skill building will be passed on to the field assistants wherever possible through the research process.
9. Safety of participants and researchers will be given utmost importance when carrying out research activities. Fieldwork will be interrupted if an unsafe situation arises.

#### POST-RESEARCH PRINCIPLES

10. The information gathered will be used for the purpose of completing Masters theses by the UCT students and providing a scientific analysis of the landscape in which the Mupo Foundation works.
11. Information gathered during research and results will be shared with the community through the production of a poster and providing Mupo with digital copies of the produced theses. Geo-spatial data and maps developed through the research will also be provided to Mupo and/or the community, together with all other information collected and not used in the theses, in whatever form appropriate, for Mupo's archives and use. Where information belongs to another person or institution, permission will be required for release of materials.
12. Participants and the community will be credited for their tangible and intangible contributions according to their preference.
13. If the research is used for publication, Mupo will be asked to comment on the draft before submission and to agree the final text.
14. No information gathered with Mupo's assistance will be placed in the public domain without the consent of Mupo.

## **Appendix B: GIS Layer Information**

<b>Layer</b>	<b>Dataset Description</b>	<b>Date</b>	<b>Format</b>	<b>Source</b>
Geology	Geological Formations & Faults	1989	Shapefiles – polygons and lines	Geoscience Council of South Africa
Soils	Soil and Terrain Database for Southern Africa 1:2000000	2011	Shapefile (converted from ArcInfo native format) - polygon	International Soil Reference and Information Centre - World Soil Information (ISRIC , Netherlands)
Topography (10m contours)	10m Hyps elevation, sheet 2230 (file name: F2230C_HYPS_ELEVATION_LINES10_2011_07)	2011	Shapefile - lines	National Geo-spatial Information (NGI, RSA)
Gradient	Digital elevation model (DEM) 10m resolution derived from Topography layer	2009	Raster	Derived from National Geo-spatial Institute (NGI, RSA)
Aspect	Digital elevation model (DEM) 10m resolution derived from Topography layer	2009	Raster	Derived from National Geo-spatial Institute (NGI, RSA)
Hydrology	10m Hyps elevation, River Line, and Inland Water, sheet 2230 (file names: F2230C_HYPS_ELEVATION_LINES10_2011_07, 2230_RIVER_LINE_2006_04, 2230_INLAND_WATER_AREA_2006_04)	2006-2011	Shapefile – lines & polygons	National Geospatial Institute (NGI, RSA)
National Aerial Photography	0.5m GSD (Ground Sample Distance) national aerial photography, sheet 2230CD, tiles 6-8 and 11-13	2009	Raster	National Geospatial Institute (NGI, RSA)
Land cover classification	Land cover classification derived manually from 0.5m GSD (Ground Sample Distance) national aerial photography, sheet 2230CD, tiles 6-8 and 11-13	2012	Shapefile - polygons	Derived by researcher as part of this project

### **Appendix C: Guided Site Investigation Details**

<b>Date</b>	<b>Participant</b>	<b>Occupation</b>	<b>Area Investigated</b>
Jan 25	Elder Ramudinqani	Cattle herder	Pasture southeast of Tshidzivhe
Jan 27	Makhadzis: Vhakoma Vho-Joyce Vho-Nancy Vho-Dora	House wives/ Makhadzis	Forest southwest of Chief's Kraal
Jan 28	Mashonelo	Young Traditional Healer	Tshilungwi and south mountain to plantation and forest SW of Tshidzivhe
Jan 30	Wood carvers: Pietres Mashonelo's father	Wood carvers	Forest southwest of Tshidzivhe to plantation edge
Feb 1	Makhadzis: Vhakoma Vho-Joyce Vho-Nancy Vho-Dora Vho-Tshisikawa	House wives/ Makhadzis	Plantation road west of Tshidzivhe to river at road via low slopes of Mapoli mountain and to
Feb 2	Chief & Sidande resident	Chief & headman (pastor)	Lake Fundudzi via Tshilungwi and Sidande. Return via Mulume
Feb 3	Elder Aaron	Development contractor	Plantation roads including Tshitangane, Mukumbani Dam, Mukumbani waterfalls, and Thathe Forest
Feb 4	Elder Ramudinqani	Cattle herder	Nwanani via southwest forest and plantation edge

### **Appendix D: Key Informant Details**

<b>Date of communication</b>	<b>Key Informant</b>	<b>Position</b>	<b>Organisation</b>
Jan 18	Edward Mabogo	Director of Environmental Research and Development	LEDET
Jan 19	Ben van der Waal	Former Limnology professor	University of Venda
Jan 20	Mr. Maluleke Mr. Munjedzi Mr. Mbolah	Director of Planning Local Economic Dev't GIS and Environment	Thulamela Municipality
Jan 20	Dr. Ligavha-Mbelengwa	Head of Botany	University of Venda
Jan 25	Elder Ramudingani	Cattle herder	Tshidzivhe Village
Jan 26	Elder Masuda	Wood carver	Tshidzivhe Village
Jan 26	Elder Phiniase Netshidzivhe	Wood carver	Tshidzivhe Village
Jan 27	Makhadzis	House wives, ritual carriers	Tshidzivhe Village
Jan 28	Mashonelo	Young Traditional Healer	Tshidzivhe Village
Jan 31	Elder Aaron	Commercial constructor	Tshidzivhe Village
Feb 1	Makhadzis	House wives, ritual carriers	Tshidzivhe Village
Feb 5	Chief Netshidzivhe	Tshidzivhe village Chief	Tshidzivhe Village
Feb 6	Vhakoma	Chief's mother	Tshidzivhe Village
Feb 6	Makhadzis	House wives, ritual carriers	Tshidzivhe Village
Feb 8	Mr. Nkumeleni Livhebe Mrs. Gloria Nekhavambe	Agri-business Manager Natural Resources Manager	Limpopo Department of Agriculture
Feb 8	Mr. Emanuel Tshabuse	Former Natural Resources Manager, currently agricultural technician at Mutale Municipality	Mutale Municipality
Feb 8	Ms. Lorraine Egan	Environmental Practitioner	Komatiland Forests
Feb 10	Mr. Elliot Nemakhavhani	Forester at Entabeni plantation (was responsible for liaison with Tshidzivhe); Elder who grew up in area where plantation is now located	Komatiland Forests
Feb 10	Mr. Norman Khosa	Forester at Entabeni plantation (responsible for liaison with Tshidzivhe)	Komatiland Forests
July 17	Mrs. Elfrieda Pschorn- Strauss <sup>1</sup>	Director	Mupo Foundation

---

<sup>1</sup> Personal communication received by email.



## **Appendix E: Key Informant Interview Questions**

The following are general lists of questions asked during interviews for the different groups of key informants: Government officials, academics, forestry plantation managers, and the community of Tshidzivhe (including Chief Netshidzivhe). These questions were tailored specifically to the person interviewed, their position, and expertise.

### **Government officials**

1. What is your role at Vhembe/Thulamela/LEDET/Department of Agriculture and what does it entail?
2. Is there an environmental plan for rural areas around Thohoyandou? What political boundaries apply to this plan?
3. Where do the environmental plans for the area referred to by Thulamela officials come from? Do you know how I can get a hold of the environmental plan documents? Who authored these plans?
4. Who authors the IDP?
5. How does the decision-making process between government and traditional leaders happen? At what stage do traditional leaders get involved in the decision-making process?
6. What is the Land Development Forum responsible for? Who takes part in this forum? How often do the forum meetings happen?
7. What types of land-use changes do traditional leaders approach the municipality for?
8. What is the channel of communication used by Chiefs to discuss land-use issues with municipalities?
9. Do traditional leaders usually deal with Vhembe District or Thulamela municipality?
10. What is the difference in the roles and responsibilities between Vhembe and Thulamela?
11. In terms of deforestation and other environmental issues, which municipality deals with these issues?
12. Are there any specific government strategies to counteract deforestation?
13. How far along is the process for the Vhembe biosphere? What kinds of issues are they dealing with?
14. What are the actual initiatives of the biosphere? Will it provide protection in any way for environmentally sensitive or environmentally degraded areas?
15. Regarding the Thathe Vondo plantation, does your office deal with any commercial plantation issues?
16. Do you conduct assessments on water availability and quality?
17. How do you include biodiversity issues into decision-making?
18. Does your department get involved in the issue of overharvesting of medicinal plants?
19. How much stakeholder involvement is there when forest is to be converted to fields or residential stands? Who are the stakeholders?
20. Are there any challenges with soil erosion? Any municipal/provincial strategies to deal with that?
21. To what degree is cattle grazing an issue when it comes to soil erosion?
22. In terms of environmental conservation of the area, like the trees, who gets involved in case of felling of trees?
23. Do you feel that the Chiefs find there's a need for indigenous plant protection?

## Academics

1. Can you describe your past work at University of Venda and the areas investigated by your research?
2. How is it that Thathe Forest and Lake Fundudzi have remained relatively untouched by development and commercial plantation? Are there other factors at play other than cultural importance of these places?
3. How does the integrity of Thathe Forest affect the surrounding landscape in terms of water quantity and quality in the area?
4. How has the plantation affected the meso-climate and local conditions of the area in terms of temperatures and rainfall? Has this had any other ecological impacts?
5. Are there any ecological benefits to the existence of commercial forestry in the area?
6. From your experience, which government departments have had the most influence over the study area? How has this impacted sacred sites?
7. Are you aware of any mechanisms used by government to involve community in decision-making? How do they secure consent?
8. How effective is legislation protecting the sacred sites and surrounding landscape from environmental damage?
9. What kind of impact has the land claim process had on land-use change in the study area, in terms of change from indigenous vegetation to agriculture/commercial plantation?
10. What are the problem alien species in the study area? What type of areas are they usually found in?
11. What types of solutions are used for alien plant eradication?
12. What ecological effects do alien plants have in the study area?
13. How effective are buffer zones around wetlands implemented in the study area?
14. How do alien species affect the biodiversity of the area?
15. How has the landscape in the study area changed over time?
16. Is the alien plants legislation effective? How could it be improved?

## Commercial Forestry Managers

1. What is your role at Komatiland and what does it entail?
2. How is it that some special areas like the Holy Forest did not get cleared for commercial plantation?
3. How do Special Interest Areas get determined? How is the list compiled?
4. How does the community bring issues to your attention? What is the channel of communication?
5. In terms of areas that are not planted, like steep ravines, are there benchmark rules as to what is planted and what is retained?
6. What is the buffer zone in metres for riparian areas? Do ephemeral and perennial rivers receive buffers?
7. Do you simply wait for natural veg to grow in delineated cleared areas? Is there any kind of rehab/monitoring/management?
8. Which acts set the legislation for Komatiland's environmental obligations?
9. Are there any issues with encroachment by indigenous vegetation into the plantation or vice versa?
10. How is weed removal/control done?
11. How does the land claim process change Komatiland's practices?

12. How is water usage by the plantation and effects on adjacent indigenous forest assessed?
13. Are chemicals from herbicide sprays measured in water quality?
14. In your opinion, are wild vegetables safe to eat from the plantation? Are cows safe to graze in plantation? Are the herbicides generally safe given that the land is used by local people for grazing and harvesting?
15. Are cattle a problem for management of the plantation?
16. Which types of land cover would have been cleared to plant the plantation during its establishment?
17. How is monitoring of medicinal plants done?
18. What happens if you detect an increase in harvesting?
19. What is the status of the conservation areas?
20. How extensive is your list of rare plants that require active conservation measures within plantation boundaries? How are protection practices actually implemented?
21. What is the reason for leaving small patches of natural areas amidst compartments of pine plantation?

#### Tshidzivhe Community and Chief Netshidzivhe

1. Can you describe what your work as Chief entails? (Chief only)
2. Looking back in the past (in your grandfather's times), how has the landscape changed? Have there been any dramatic changes linked to the natural vegetation?
3. In what year did people leave their old homes in the landscape and move to Tshidzivhe?
4. Can you describe the landscape change in this area (Tshidzivhe village) since 1994?
5. Have people had to move their homesteads because of soil erosion?
6. How stable are the sloped areas with current cultivated fields?
7. Has the plantation expanded in the last 20 years?
8. Did the village of Tshidzivhe expand in the last 20 years?
9. Are there people who expand fields without Chief's permission?
10. Do people need permission to plant eucalyptus groves? Did the people that plant the eucalyptus groves get permission?
11. How do you work with government around decision-making?
12. Do you work with Vhembe or Thulamela municipalities?
13. How often do you meet? How close is the communication between you and municipal government?
14. Which issues do you deal with Thulamela, and which other with Vhembe?
15. Do you have a future land-use plan or vision for Tshidzivhe territory?
16. Are there any other areas other than the sacred sites which are protected? Which ones? Why are they protected?
17. Why are sacred sites important?
18. What ecological reasons are there for the place to be special (or sacred)?
19. Some trees are scarce now and hard to find, are those only trees that grow in "deme" (mistbelt forest)? For what reasons do you think these trees are scarce now?
20. How much bigger was Thathe prior to the plantation? How much area/land did the plantation take away from Thathe?
21. What are the rules for protecting Thathe Forest?

22. What happens if someone breaks these rules? Will the entire community be punished or just the trespassers?
23. Are there any other parts of the Tshidzivhe landscape that haven't changed in a long time other than the sacred sites?
24. In terms of different landscape types, for example, gwara, vuvhu, daka, midavini, thathani, deme; are there any that are missing from this list?